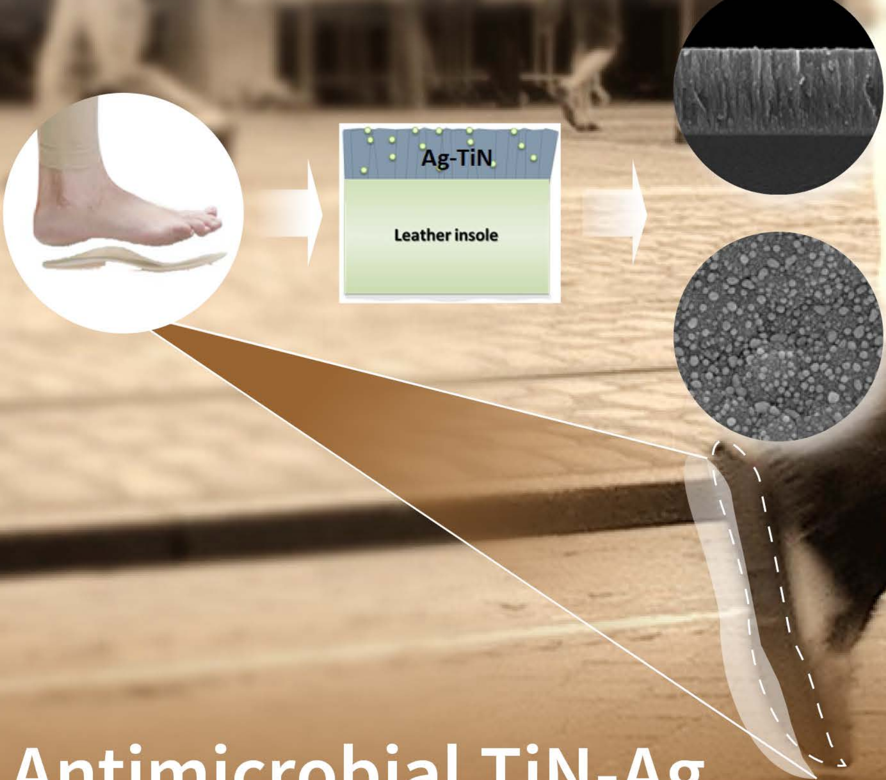
materials



Antimicrobial TiN-Ag Coatings in Leather Insole for Diabetic Foot

Volume 15 · Issue 6 | March (II) 2022

MDPI

mdpi.com/journal/materials
ISSN 1996-1944

materials (/journal/materials)

IMPACT FACTOR 3.748

Indexed in: PubMed (https://www.ncbi.nlm.nih.gov/pubmed/?term=1996-1944)

Editorial Board for section 'Biomaterials'

- **Biomaterials Section (/journal/materials/sectioneditors/biomaterials)**
- **Energy Materials Section (/journal/materials/sectioneditors/mater_energy)**
- **Advanced Composites Section (/journal/materials/sectioneditors/adv_composites)**
- **Advanced Materials Characterization Section (/journal/materials/sectioneditors/struct_analysis)**
- **Porous Materials Section (/journal/materials/sectioneditors/porous_materials)**
- **Manufacturing Processes and Systems Section (/journal/materials/sectioneditors/manufacturing_process)**
- **Advanced Nanomaterials and Nanotechnology Section (/journal/materials/sectioneditors/adv_nano)**
- **Smart Materials Section (/journal/materials/sectioneditors/smart_materials)**
- **Thin Films and Interfaces Section (/journal/materials/sectioneditors/thin_films_interfaces)**
- **Catalytic Materials Section (/journal/materials/sectioneditors/catalytic)**
- **Carbon Materials Section (/journal/materials/sectioneditors/carbon)**
- **Materials Chemistry Section (/journal/materials/sectioneditors/Mater_chemistry)**
- **Materials Physics Section (/journal/materials/sectioneditors/Physics)**
- **Optics and Photonics Section (/journal/materials/sectioneditors/optics_photonics)**
- **Corrosion Section (/journal/materials/sectioneditors/cmd)**
- **Construction and Building Materials Section (/journal/materials/sectioneditors/Construction_and_Building_Materials)**
- **Materials Simulation and Design Section (/journal/materials/sectioneditors/Materials_Simulation_Design)**
- **Electronic Materials Section (/journal/materials/sectioneditors/electronic_materials)**
- **Advanced and Functional Ceramics and Glasses Section (/journal/materials/sectioneditors/Advanced_Functional_Ceramics)**
- **Metals and Alloys Section (/journal/materials/sectioneditors/metals_alloys)**
- **Soft Matter Section (/journal/materials/sectioneditors/soft_matter)**
- **Polymeric Materials Section (/journal/materials/sectioneditors/polymeric_materials)**
- **Quantum Materials Section (/journal/materials/sectioneditors/quantum_materials)**
- **Mechanics of Materials Section (/journal/materials/sectioneditors/mechanics_materials)**
- **Green Materials Section (/journal/materials/sectioneditors/green_materials)**

Please see **the section webpage (/journal/materials/sections/biomaterials)** for more information on this section.

Members (215)

Search by first name, last name, affiliation,

Back to TopTop

Back to TopTop

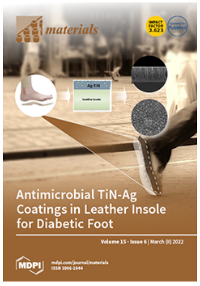
 (/)

[⛶ (/toggle_desktop_layout_cookie)]

Back to TopTop

***Materials* (/journal/materials)**, EISSN 1996-1944, Published by MDPI

Materials, Volume 15, Issue 6 (March-2 2022) – 357 articles



Cover Story (**view full-size image (/files/uploaded/covers/materials/big_cover-materials-v15-i6.png)**): This work reports on TiN-Ag antimicrobial coatings deposited by DC magnetron sputtering on leather for insoles on the footwear industry and studies involving the antimicrobial properties of these coatings. The XRD results suggested the presence of a crystalline fcc-TiN phase and a fcc-Ag phase in the samples containing silver. SEM analysis shows that coatings were homogeneous, and dispersed Ag clusters were found on samples with silver content above 8 at.%. ICP-OES spectrometry analysis showed that the ionization of silver over time depends on the morphology of coatings. The samples did not present cytotoxicity and only samples with silver presented antibacterial and antifungal activity, highlighting the potential of the TiN-Ag insole coatings for diseases such as diabetic foot. **View this paper (https://www.mdpi.com/1996-1944/15/6/2009)**

(https://www.mdpi.com/1996-1944/15/6/2009)

- Issues are regarded as officially published after their release is announced to the **table of contents alert mailing list (/journal/materials/toc-alert)**.
- You may **sign up for e-mail alerts (/journal/materials/toc-alert)** to receive table of contents of newly released issues.
- PDF is the official format for papers published in both, html and pdf forms. To view the papers in pdf format, click on the "PDF Full-text" link, and use the free **Adobe Reader (http://www.adobe.com/)** to open them.

Order results

Publication Date

Result details

Compact

Section

All Sections

Show export options

Open Access Article (/1996-1944/15/6/2339/pdf?version=1647932082)

Study of Compatibility and Flame Retardancy of TPU/PLA Composites (/1996-1944/15/6/2339)

Materials **2022**, *15*(6), 2339; **https://doi.org/10.3390/ma15062339 (https://doi.org/10.3390/ma15062339)** - 21 Mar 2022

Open Access Article (/1996-1944/15/6/2338/pdf?version=1647927104)

Design, Fabrication, and Mechanical Properties of T-700^{TM} Multiaxial-Warp-Knitting–Needled–C/SiC Composite and Pin (/1996-1944/15/6/2338)

Materials **2022**, *15*(6), 2338; **https://doi.org/10.3390/ma15062338 (https://doi.org/10.3390/ma15062338)** - 21 Mar 2022

Open Access Article (/1996-1944/15/6/2337/pdf?version=1647997820)

Effect of the P/Al Molar Ratio and Heating Rate on the Composi-Tion of Alumino-Phosphate Binders (/1996-1944/15/6/2337)

Materials **2022**, *15*(6), 2337; **https://doi.org/10.3390/ma15062337 (https://doi.org/10.3390/ma15062337)** - 21 Mar 2022

Open Access Article (/1996-1944/15/6/2336/pdf?version=1647939971)

MDPI (/)

Fabrication of MnCuNiFe–CuAlNiFeMn Gradient Alloy by Laser Engineering Net Shaping System (/1996-1944/15/6/2336)

Materials **2022**, *15*(6), 2336; **https://doi.org/10.3390/ma15062336 (https://doi.org/10.3390/ma15062336)** - 21 Mar 2022

(/toggle_desktop_layout_cookie)

Open Access Article (/1996-1944/15/6/2335/pdf?version=1647946611)

Immobilization of Hexavalent Chromium Using Self-Compacting Soil Technology (/1996-1944/15/6/2335)

Materials **2022**, *15*(6), 2335; **https://doi.org/10.3390/ma15062335 (https://doi.org/10.3390/ma15062335)** - 21 Mar 2022

Open Access Article (/1996-1944/15/6/2334/pdf?version=1647874615)

Assessment of the Impact of Wear of the Working Surface of Rolls on the Reduction of Energy and Environmental Demand for the Production of Flat Products: Methodological Approach (/1996-1944/15/6/2334)

Materials **2022**, *15*(6), 2334; **https://doi.org/10.3390/ma15062334 (https://doi.org/10.3390/ma15062334)** - 21 Mar 2022

Open Access Article (/1996-1944/15/6/2333/pdf?version=1647930917)

Binarization Mechanism Evaluation for Water Ingress Detectability in Honeycomb Sandwich Structure Using Lock-In Thermography (/1996-1944/15/6/2333)

Materials **2022**, *15*(6), 2333; **https://doi.org/10.3390/ma15062333 (https://doi.org/10.3390/ma15062333)** - 21 Mar 2022

Open Access Article (/1996-1944/15/6/2332/pdf?version=1647941430)

Mortar Bond Strength: A Brief Literature Review, Tests for Analysis, New Research Needs and Initial Experiments (/1996-1944/15/6/2332)

Materials **2022**, *15*(6), 2332; **https://doi.org/10.3390/ma15062332 (https://doi.org/10.3390/ma15062332)** - 21 Mar 2022

Open Access Article (/1996-1944/15/6/2331/pdf?version=1647941783)

Functioning of Heat Accumulating Composites of Carbon Recyclate and Phase Change Material (/1996-1944/15/6/2331)

Materials **2022**, *15*(6), 2331; **https://doi.org/10.3390/ma15062331 (https://doi.org/10.3390/ma15062331)** - 21 Mar 2022

Open Access Feature Paper Article (/1996-1944/15/6/2330/pdf?version=1647998368)

Nonlinear Optical Limiting and Radiation Shielding Characteristics of Sm_2O_3 Doped Cadmium Sodium Lithium Borate Glasses (/1996-1944/15/6/2330)

Materials **2022**, *15*(6), 2330; **https://doi.org/10.3390/ma15062330 (https://doi.org/10.3390/ma15062330)** - 21 Mar 2022

Open Access Editor's Choice Article (/1996-1944/15/6/2329/pdf?version=1647932490)

Numerical Simulation of Damage Evolution and Electrode Deformation of X100 Pipeline Steel during Crevice Corrosion (/1996-1944/15/6/2329)

Materials **2022**, *15*(6), 2329; **https://doi.org/10.3390/ma15062329 (https://doi.org/10.3390/ma15062329)** - 21 Mar 2022

Open Access Article (/1996-1944/15/6/2328/pdf?version=1647931600)

Strengthening of Reinforced Concrete Beams Subjected to Concentrated Loads Using Externally Bonded Fiber Composite Materials (/1996-1944/15/6/2328)

Materials **2022**, *15*(6), 2328; **https://doi.org/10.3390/ma15062328 (https://doi.org/10.3390/ma15062328)** - 21 Mar 2022

Open Access Article (/1996-1944/15/6/2327/pdf?version=1647862305)

Preparation and Properties of Pea Starch/ε-Polylysine Composite Films (/1996-1944/15/6/2327)

Materials **2022**, *15*(6), 2327; **https://doi.org/10.3390/ma15062327 (https://doi.org/10.3390/ma15062327)** - 21 Mar 2022

Open Access Article (/1996-1944/15/6/2326/pdf?version=1647929137)

Effectiveness of Some Novel Ionic Liquids on Mild Steel Corrosion Protection in Acidic Environment: Experimental and Theoretical Inspections (/1996-1944/15/6/2326)

Materials **2022**, *15*(6), 2326; **https://doi.org/10.3390/ma15062326 (https://doi.org/10.3390/ma15062326)** - 21 Mar 2022

Open Access Article (/1996-1944/15/6/2325/pdf?version=1647859302)

A Numerical Analysis of Ductile Deformation during Nanocutting of Silicon Carbide via Molecular Dynamics Simulation (/1996-1944/15/6/2325)

Materials **2022**, *15*(6), 2325; **https://doi.org/10.3390/ma15062325 (https://doi.org/10.3390/ma15062325)** - 21 Mar 2022

Open Access Article (/1996-1944/15/6/2324/pdf?version=1647857374)

Fabrication and Characterization of Submicron-Scale Bovine Hydroxyapatite: A Top-Down Approach for a Natural Biomaterial (/1996-1944/15/6/2324)

Materials **2022**, *15*(6), 2324; **https://doi.org/10.3390/ma15062324 (https://doi.org/10.3390/ma15062324)** - 21 Mar 2022

Open Access Article (/1996-1944/15/6/2323/pdf?version=1648025781)

Open Access Article (/1996-1944/15/6/2309/pdf?version=1647923584)

Electric and Dielectric Properties in Low-Frequency Fields of Composites Consisting of Silicone Rubber and Al Particles for Flexible Electronic Devices (/1996-1944/15/6/2309)

Materials **2022**, *15*(6), 2309; https://doi.org/10.3390/ma15062309 (https://doi.org/10.3390/ma15062309) - 21 Mar 2022

Open Access Article (/1996-1944/15/6/2308/pdf?version=1647781488)

Enhancement of Anticorrosive Performance of Cardanol Based Polyurethane Coatings by Incorporating Magnetic Hydroxyapatite Nanoparticles (/1996-1944/15/6/2308)

Materials **2022**, *15*(6), 2308; https://doi.org/10.3390/ma15062308 (https://doi.org/10.3390/ma15062308) - 20 Mar 2022

Open Access Article (/1996-1944/15/6/2307/pdf?version=1647782616)

Multilayer Nonwoven Inserts with Aerogel/PCMs for the Improvement of Thermophysiological Comfort in Protective Clothing against the Cold (/1996-1944/15/6/2307)

Materials **2022**, *15*(6), 2307; https://doi.org/10.3390/ma15062307 (https://doi.org/10.3390/ma15062307) - 20 Mar 2022

Open Access Article (/1996-1944/15/6/2306/pdf?version=1647779415)

Characterization of Hydroxyapatite Film Obtained by Er:YAG Pulsed Laser Deposition on Sandblasted Titanium: An In Vitro Study (/1996-1944/15/6/2306)

Materials **2022**, *15*(6), 2306; https://doi.org/10.3390/ma15062306 (https://doi.org/10.3390/ma15062306) - 20 Mar 2022

Open Access Article (/1996-1944/15/6/2305/pdf?version=1647998588)

Gradient Printing Alginate Herero Gel Microspheres for Three-Dimensional Cell Culture (/1996-1944/15/6/2305)

Materials **2022**, *15*(6), 2305; https://doi.org/10.3390/ma15062305 (https://doi.org/10.3390/ma15062305) - 20 Mar 2022

Open Access Article (/1996-1944/15/6/2304/pdf?version=1648014587)

Experimental Study on Subgrade Material of Calcium Silicate Slag (/1996-1944/15/6/2304)

Materials **2022**, *15*(6), 2304; https://doi.org/10.3390/ma15062304 (https://doi.org/10.3390/ma15062304) - 20 Mar 2022

Open Access Article (/1996-1944/15/6/2303/pdf?version=1647775507)

Microstructural Parameters for Modelling of Superconducting Foams (/1996-1944/15/6/2303)

Materials **2022**, *15*(6), 2303; https://doi.org/10.3390/ma15062303 (https://doi.org/10.3390/ma15062303) - 20 Mar 2022

Open Access Article (/1996-1944/15/6/2302/pdf?version=1647772595)

Effect of Ultraviolet Light C (UV-C) Radiation Generated by Semiconductor Light Sources on Human *Beta*-Coronaviruses' Inactivation (/1996-1944/15/6/2302)

Materials **2022**, *15*(6), 2302; https://doi.org/10.3390/ma15062302 (https://doi.org/10.3390/ma15062302) - 20 Mar 2022

Open Access Article (/1996-1944/15/6/2301/pdf?version=1647772106)

Experimental Study on Seismic Behavior of PC Walls with Alveolar-Type Horizontal Joint under Pseudo-Static Loading (/1996-1944/15/6/2301)

Materials **2022**, *15*(6), 2301; https://doi.org/10.3390/ma15062301 (https://doi.org/10.3390/ma15062301) - 20 Mar 2022

Open Access Article (/1996-1944/15/6/2300/pdf?version=1647772017)

Application of the Sinter-HIP Method to Manufacture Cr–Mo–W–V–Co High-Speed Steel via Powder Metallurgy (/1996-1944/15/6/2300)

Materials **2022**, *15*(6), 2300; https://doi.org/10.3390/ma15062300 (https://doi.org/10.3390/ma15062300) - 20 Mar 2022

Open Access Article (/1996-1944/15/6/2299/pdf?version=1647771243)

Experimental and Numerical Thickness Analysis of TRIP Steel under Various Degrees of Deformation in Bulge Test (/1996-1944/15/6/2299)

Materials **2022**, *15*(6), 2299; https://doi.org/10.3390/ma15062299 (https://doi.org/10.3390/ma15062299) - 20 Mar 2022

Open Access Article (/1996-1944/15/6/2298/pdf?version=1647770703)

Medium-Entropy $SrV_{1/3}Fe_{1/3}Mo_{1/3}O_3$ with High Conductivity and Strong Stability as SOFCs High-Performance Anode (/1996-1944/15/6/2298)

Materials **2022**, *15*(6), 2298; https://doi.org/10.3390/ma15062298 (https://doi.org/10.3390/ma15062298) - 20 Mar 2022

Open Access Article (/1996-1944/15/6/2297/pdf?version=1647769008)

Effect of Water–Solid Mixing Sequence and Crystallization Water of Calcium Sulphate on the Hydration of C_3A (/1996-1944/15/6/2297)

Materials **2022**, *15*(6), 2297; https://doi.org/10.3390/ma15062297 (https://doi.org/10.3390/ma15062297) - 20 Mar 2022

Open Access Editor's Choice Article (/1996-1944/15/6/2296/pdf?version=1647768619)

A Simple Structure for an Independently Tunable Infrared Absorber Based on a Non-Concentric Graphene Nanodisk (/1996-1944/15/6/2296)

Materials **2022**, *15*(6), 2296; **https://doi.org/10.3390/ma15062296 (https://doi.org/10.3390/ma15062296)** - 20 Mar 2022

Open Access Editor's Choice Article (/1996-1944/15/6/2295/pdf?version=1647768787)

Oxidation Behaviour of Microstructurally Highly Metastable Ag-La Alloy (/1996-1944/15/6/2295)

Materials **2022**, *15*(6), 2295; **https://doi.org/10.3390/ma15062295 (https://doi.org/10.3390/ma15062295)** - 20 Mar 2022

Open Access Article (/1996-1944/15/6/2294/pdf?version=1648015910)

Analysis on Seismic Performance of Steel-Reinforced Concrete-Filled Circular Steel Tubular (SRCFST) Members Subjected to Post-Fire (/1996-1944/15/6/2294)

Materials **2022**, *15*(6), 2294; **https://doi.org/10.3390/ma15062294 (https://doi.org/10.3390/ma15062294)** - 20 Mar 2022

Open Access Article (/1996-1944/15/6/2293/pdf?version=1647855884)

Influence of Monocalcium Phosphate on the Properties of Bioactive Magnesium Phosphate Bone Cement for Bone Regeneration (/1996-1944/15/6/2293)

Materials **2022**, *15*(6), 2293; **https://doi.org/10.3390/ma15062293 (https://doi.org/10.3390/ma15062293)** - 20 Mar 2022

Open Access Article (/1996-1944/15/6/2292/pdf?version=1647998196)

Magnetic Instabilities in the Quasi-One-Dimensional $K_2Cr_3As_3$ Material with Twisted Triangular Tubes (/1996-1944/15/6/2292)

Materials **2022**, *15*(6), 2292; **https://doi.org/10.3390/ma15062292 (https://doi.org/10.3390/ma15062292)** - 20 Mar 2022

Open Access Article (/1996-1944/15/6/2291/pdf?version=1647765936)

***Acacia nilotica* Pods' Extract Assisted-Hydrothermal Synthesis and Characterization of ZnO-CuO Nanocomposites (/1996-1944/15/6/2291)**

Materials **2022**, *15*(6), 2291; **https://doi.org/10.3390/ma15062291 (https://doi.org/10.3390/ma15062291)** - 20 Mar 2022

Open Access Article (/1996-1944/15/6/2290/pdf?version=1647764306)

Foundational Investigation on the Characterization of Porosity and Fiber Orientation Using XCT in Large-Scale Extrusion Additive Manufacturing (/1996-1944/15/6/2290)

Materials **2022**, *15*(6), 2290; **https://doi.org/10.3390/ma15062290 (https://doi.org/10.3390/ma15062290)** - 20 Mar 2022

Open Access Editor's Choice Article (/1996-1944/15/6/2289/pdf?version=1647857594)

Fabrication of Type-Variable Electronic Paper Using Electrophoretic Particle Loading with Multiple Bottom Electrode Structure (/1996-1944/15/6/2289)

Materials **2022**, *15*(6), 2289; **https://doi.org/10.3390/ma15062289 (https://doi.org/10.3390/ma15062289)** - 20 Mar 2022

Open Access Article (/1996-1944/15/6/2288/pdf?version=1647758118)

Numerical Simulation of Tailings Flow from Dam Failure over Complex Terrain (/1996-1944/15/6/2288)

Materials **2022**, *15*(6), 2288; **https://doi.org/10.3390/ma15062288 (https://doi.org/10.3390/ma15062288)** - 20 Mar 2022

Open Access Article (/1996-1944/15/6/2287/pdf?version=1648018567)

Preparation and Properties of Electrodeposited Ni-B-Graphene Oxide Composite Coatings (/1996-1944/15/6/2287)

Materials **2022**, *15*(6), 2287; **https://doi.org/10.3390/ma15062287 (https://doi.org/10.3390/ma15062287)** - 20 Mar 2022

Open Access Review (/1996-1944/15/6/2286/pdf?version=1647855815)

Complex Metal Borohydrides: From Laboratory Oddities to Prime Candidates in Energy Storage Applications (/1996-1944/15/6/2286)

Materials **2022**, *15*(6), 2286; **https://doi.org/10.3390/ma15062286 (https://doi.org/10.3390/ma15062286)** - 19 Mar 2022

Open Access Article (/1996-1944/15/6/2285/pdf?version=1649852533)

Influence of ZnF_2 and WO_3 on Radiation Attenuation Features of Oxyfluoride Tellurite WO_3-ZnF_2-TeO_2 Glasses Using Phy-X/PSD Software (/1996-1944/15/6/2285)

Materials **2022**, *15*(6), 2285; **https://doi.org/10.3390/ma15062285 (https://doi.org/10.3390/ma15062285)** - 19 Mar 2022

Open Access Article (/1996-1944/15/6/2284/pdf?version=1647686065)

Thermoelectric Properties of Cu_2Te Nanoparticle Incorporated N-Type $Bi_2Te_{2.7}Se_{0.3}$ (/1996-1944/15/6/2284)

Materials **2022**, *15*(6), 2284; **https://doi.org/10.3390/ma15062284 (https://doi.org/10.3390/ma15062284)** - 19 Mar 2022

Open Access Article (/1996-1944/15/6/2283/pdf?version=1647685579)

Optimization of Embedded Sensor Packaging Used in Rollpave Pavement Based on Test and Simulation (/1996-1944/15/6/2283)

Materials **2022**, *15*(6), 2283; **https://doi.org/10.3390/ma15062283 (https://doi.org/10.3390/ma15062283)** - 19 Mar 2022

Open Access Article (/1996-1944/15/6/2282/pdf?version=1647687114)

The Effect of Hf Addition on the Boronizing and Siliciding Behavior of CoCrFeNi High Entropy Alloys (/1996-1944/15/6/2282)

Materials **2022**, *15*(6), 2282; **https://doi.org/10.3390/ma15062282 (https://doi.org/10.3390/ma15062282)** - 19 Mar 2022

Open Access Article (/1996-1944/15/6/2281/pdf?version=1647683074)

Feasibility Study on the Steel-Plastic Geogrid Instead of Wire Mesh for Bolt Mesh Supporting (/1996-1944/15/6/2281)

Materials **2022**, *15*(6), 2281; **https://doi.org/10.3390/ma15062281 (https://doi.org/10.3390/ma15062281)** - 19 Mar 2022

Open Access Article (/1996-1944/15/6/2280/pdf?version=1647682472)

Dynamic Alloying of Steels in the Super-Deep Penetration Mode (/1996-1944/15/6/2280)

Materials **2022**, *15*(6), 2280; **https://doi.org/10.3390/ma15062280 (https://doi.org/10.3390/ma15062280)** - 19 Mar 2022

Open Access Article (/1996-1944/15/6/2279/pdf?version=1647824779)

The Effect of Stray Current on Calcium Leaching of Cement-Based Materials (/1996-1944/15/6/2279)

Materials **2022**, *15*(6), 2279; **https://doi.org/10.3390/ma15062279 (https://doi.org/10.3390/ma15062279)** - 19 Mar 2022

Open Access Article (/1996-1944/15/6/2278/pdf?version=1647916701)

Electronic States of Tris(bipyridine) Ruthenium(II) Complexes in Neat Solid Films Investigated by Electroabsorption Spectroscopy (/1996-1944/15/6/2278)

Materials **2022**, *15*(6), 2278; **https://doi.org/10.3390/ma15062278 (https://doi.org/10.3390/ma15062278)** - 19 Mar 2022

Open Access Article (/1996-1944/15/6/2277/pdf?version=1647681312)

New Metastable Baro- and Deformation-Induced Phases in Ferromagnetic Shape Memory Ni_2MnGa-Based Alloys (/1996-1944/15/6/2277)

Materials **2022**, *15*(6), 2277; **https://doi.org/10.3390/ma15062277 (https://doi.org/10.3390/ma15062277)** - 19 Mar 2022

Open Access Article (/1996-1944/15/6/2276/pdf?version=1648000417)

Physical and Numerical Simulations on Mechanical Properties of a Prefabricated Underground Utility Tunnel (/1996-1944/15/6/2276)

Materials **2022**, *15*(6), 2276; **https://doi.org/10.3390/ma15062276 (https://doi.org/10.3390/ma15062276)** - 19 Mar 2022

Open Access Article (/1996-1944/15/6/2275/pdf?version=1647682411)

Impact of Surface Changes and Microbial Adhesion on Mucosal Surface Finishing of Resin Denture Bases by Shot Blast Polishing Using Viscoelastic Media (/1996-1944/15/6/2275)

Materials **2022**, *15*(6), 2275; **https://doi.org/10.3390/ma15062275 (https://doi.org/10.3390/ma15062275)** - 19 Mar 2022

Open Access Article (/1996-1944/15/6/2274/pdf?version=1647949297)

Devising Bone Molecular Models at the Nanoscale: From Usual Mineralized Collagen Fibrils to the First Bone Fibers Including Hydroxyapatite in the Extra-Fibrillar Volume (/1996-1944/15/6/2274)

Materials **2022**, *15*(6), 2274; **https://doi.org/10.3390/ma15062274 (https://doi.org/10.3390/ma15062274)** - 19 Mar 2022

Open Access Feature Paper Review (/1996-1944/15/6/2273/pdf?version=1647677491)

Welding Techniques for High Entropy Alloys: Processes, Properties, Characterization, and Challenges (/1996-1944/15/6/2273)

Materials **2022**, *15*(6), 2273; **https://doi.org/10.3390/ma15062273 (https://doi.org/10.3390/ma15062273)** - 19 Mar 2022

Open Access Article (/1996-1944/15/6/2272/pdf?version=1647864778)

Simple Methods for Evaluating Acid Permeation and Biofilm Formation Behaviors on Polysiloxane Films (/1996-1944/15/6/2272)

Materials **2022**, *15*(6), 2272; **https://doi.org/10.3390/ma15062272 (https://doi.org/10.3390/ma15062272)** - 19 Mar 2022

Open Access Article (/1996-1944/15/6/2271/pdf?version=1647945887)

Effect of Biochar Addition on Mechanical Properties, Thermal Stability, and Water Resistance of Hemp-Polylactic Acid (PLA) Composites (/1996-1944/15/6/2271)

Materials **2022**, *15*(6), 2271; **https://doi.org/10.3390/ma15062271 (https://doi.org/10.3390/ma15062271)** - 19 Mar 2022

Open Access Article (/1996-1944/15/6/2270/pdf?version=1647931305)

Effective Viscoplastic-Softening Model Suitable for Brain Impact Modelling (/1996-1944/15/6/2270)

Materials **2022**, *15*(6), 2270; **https://doi.org/10.3390/ma15062270 (https://doi.org/10.3390/ma15062270)** - 18 Mar 2022

Open Access Article (/1996-1944/15/6/2269/pdf?version=1648021653)

Estimate of Coffin–Manson Curve Shift for the Porous Alloy AlSi9Cu3 Based on Numerical Simulations of a Porous Material Carried Out by Using the Taguchi Array (/1996-1944/15/6/2269)

Materials **2022**, *15*(6), 2269; **https://doi.org/10.3390/ma15062269 (https://doi.org/10.3390/ma15062269)** - 18 Mar 2022

Open Access Article (/1996-1944/15/6/2268/pdf?version=1647917977)

Machining with a Precision Five-Axis Machine Tools Created by Combining a Horizontal Parallel Three-Axis Motion Platform and a Three-Axis Machine Tools (/1996-1944/15/6/2268)

MDPI (/)

Materials **2022**, *15*(6), 2268; **https://doi.org/10.3390/ma15062268 (https://doi.org/10.3390/ma15062268)** - 18 Mar 2022

(/toggle_desktop_layout_cookie)

Open Access Article (/1996-1944/15/6/2267/pdf?version=1647917493)

Praseodymium Orthoniobate and Praseodymium Substituted Lanthanum Orthoniobate: Electrical and Structural Properties (/1996-1944/15/6/2267)

Materials **2022**, *15*(6), 2267; **https://doi.org/10.3390/ma15062267 (https://doi.org/10.3390/ma15062267)** - 18 Mar 2022

Open Access Article (/1996-1944/15/6/2266/pdf?version=1647603345)

Efficacy of Ciprofloxacin, Metronidazole and Minocycline in Ordered Mesoporous Silica against *Enterococcus faecalis* for Dental Pulp Revascularization: An In-Vitro Study (/1996-1944/15/6/2266)

Materials **2022**, *15*(6), 2266; **https://doi.org/10.3390/ma15062266 (https://doi.org/10.3390/ma15062266)** - 18 Mar 2022

Open Access Article (/1996-1944/15/6/2265/pdf?version=1647943162)

Transport Mechanisms and Dielectric Features of Mg-Doped ZnO Nanocrystals for Device Applications (/1996-1944/15/6/2265)

Materials **2022**, *15*(6), 2265; **https://doi.org/10.3390/ma15062265 (https://doi.org/10.3390/ma15062265)** - 18 Mar 2022

Open Access Article (/1996-1944/15/6/2264/pdf?version=1647600985)

Calculation of Thermal Expansion Coefficient of Rare Earth Zirconate System at High Temperature by First Principles (/1996-1944/15/6/2264)

Materials **2022**, *15*(6), 2264; **https://doi.org/10.3390/ma15062264 (https://doi.org/10.3390/ma15062264)** - 18 Mar 2022

Open Access Article (/1996-1944/15/6/2263/pdf?version=1647600783)

Anaerobic Reactor Filling for Phosphorus Removal by Metal Dissolution Method (/1996-1944/15/6/2263)

Materials **2022**, *15*(6), 2263; **https://doi.org/10.3390/ma15062263 (https://doi.org/10.3390/ma15062263)** - 18 Mar 2022

Open Access Article (/1996-1944/15/6/2262/pdf?version=1647600861)

The Effects of Niobium and Molybdenum on the Microstructures and Corrosion Properties of CrFeCoNiNbxMoy Alloys (/1996-1944/15/6/2262)

Materials **2022**, *15*(6), 2262; **https://doi.org/10.3390/ma15062262 (https://doi.org/10.3390/ma15062262)** - 18 Mar 2022

Open Access Article (/1996-1944/15/6/2261/pdf?version=1647999053)

Free-Standing ZnO:Mo Nanorods Exposed to Hydrogen or Oxygen Plasma: Influence on the Intrinsic and Extrinsic Defect States (/1996-1944/15/6/2261)

Materials **2022**, *15*(6), 2261; **https://doi.org/10.3390/ma15062261 (https://doi.org/10.3390/ma15062261)** - 18 Mar 2022

Open Access Article (/1996-1944/15/6/2260/pdf?version=1647928046)

The Optical and Thermo-Optical Properties of Non-Stoichiometric Silicon Nitride Layers Obtained by the PECVD Method with Varying Levels of Nitrogen Content (/1996-1944/15/6/2260)

Materials **2022**, *15*(6), 2260; **https://doi.org/10.3390/ma15062260 (https://doi.org/10.3390/ma15062260)** - 18 Mar 2022

Open Access Article (/1996-1944/15/6/2259/pdf?version=1647596967)

Artificial Neural Network-Based Failure Pressure Prediction of API 5L X80 Pipeline with Circumferentially Aligned Interacting Corrosion Defects Subjected to Combined Loadings (/1996-1944/15/6/2259)

Materials **2022**, *15*(6), 2259; **https://doi.org/10.3390/ma15062259 (https://doi.org/10.3390/ma15062259)** - 18 Mar 2022

Open Access Article (/1996-1944/15/6/2258/pdf?version=1647829631)

Cellulose Nanofibrils as a Damping Material for the Production of Highly Crystalline Nanosized Zeolite Y via Ball Milling (/1996-1944/15/6/2258)

Materials **2022**, *15*(6), 2258; **https://doi.org/10.3390/ma15062258 (https://doi.org/10.3390/ma15062258)** - 18 Mar 2022

Open Access Article (/1996-1944/15/6/2257/pdf?version=1647595036)

Influence of Pulse Duration on X-ray Emission during Industrial Ultrafast Laser Processing (/1996-1944/15/6/2257)

Materials **2022**, *15*(6), 2257; **https://doi.org/10.3390/ma15062257 (https://doi.org/10.3390/ma15062257)** - 18 Mar 2022

Open Access Article (/1996-1944/15/6/2256/pdf?version=1647595729)

Development of Construction Material Using Wastewater: An Application of Circular Economy for Mass Production of Bricks (/1996-1944/15/6/2256)

Materials **2022**, *15*(6), 2256; **https://doi.org/10.3390/ma15062256 (https://doi.org/10.3390/ma15062256)** - 18 Mar 2022

Open Access Article ☰ (/1996-1944/15/6/2255/pdf?version=1647593942)

Low-Temperature-Processed High-Performance Pentacene OTFTs with Optimal Nd-Ti Oxynitride Mixture as Gate Dielectric (/1996-1944/15/6/2255)

Materials **2022**, *15*(6), 2255; **https://doi.org/10.3390/ma15062255 (https://doi.org/10.3390/ma15062255)** - 18 Mar 2022

Open Access Article ☰ (/1996-1944/15/6/2254/pdf?version=1647594208)

Routes for Metallization of Perovskite Solar Cells (/1996-1944/15/6/2254)

Materials **2022**, *15*(6), 2254; **https://doi.org/10.3390/ma15062254 (https://doi.org/10.3390/ma15062254)** - 18 Mar 2022

Open Access Article ☰ (/1996-1944/15/6/2253/pdf?version=1650880842)

Preparation of Poly Aluminum-Ferric Chloride (PAFC) Coagulant by Extracting Aluminum and Iron Ions from High Iron Content Coal Gangue (/1996-1944/15/6/2253)

Materials **2022**, *15*(6), 2253; **https://doi.org/10.3390/ma15062253 (https://doi.org/10.3390/ma15062253)** - 18 Mar 2022

Correction (/1996-1944/15/9/3104)

Open Access Article ☰ (/1996-1944/15/6/2252/pdf?version=1647596478)

Evaluation of Design Procedure and Performance of Continuously Reinforced Concrete Pavement According to AASHTO Design Methods (/1996-1944/15/6/2252)

Materials **2022**, *15*(6), 2252; **https://doi.org/10.3390/ma15062252 (https://doi.org/10.3390/ma15062252)** - 18 Mar 2022

Open Access Editor's Choice Article ☰ (/1996-1944/15/6/2251/pdf?version=1647592923)

Si-Doped HfO_2-Based Ferroelectric Tunnel Junctions with a Composite Energy Barrier for Non-Volatile Memory Applications (/1996-1944/15/6/2251)

Materials **2022**, *15*(6), 2251; **https://doi.org/10.3390/ma15062251 (https://doi.org/10.3390/ma15062251)** - 18 Mar 2022

Open Access Article ☰ (/1996-1944/15/6/2250/pdf?version=1647591508)

Binder-Free Porous 3D-ZnO Hexagonal-Cubes for Electrochemical Energy Storage Applications (/1996-1944/15/6/2250)

Materials **2022**, *15*(6), 2250; **https://doi.org/10.3390/ma15062250 (https://doi.org/10.3390/ma15062250)** - 18 Mar 2022

Open Access Article ☰ (/1996-1944/15/6/2249/pdf?version=1647604591)

Softened Microstructure and Properties of 12 μm Thick Rolled Copper Foil (/1996-1944/15/6/2249)

Materials **2022**, *15*(6), 2249; **https://doi.org/10.3390/ma15062249 (https://doi.org/10.3390/ma15062249)** - 18 Mar 2022

Open Access Article ☰ (/1996-1944/15/6/2248/pdf?version=1647590299)

Laser Welding of 316L Austenitic Stainless Steel in an Air and a Water Environment (/1996-1944/15/6/2248)

Materials **2022**, *15*(6), 2248; **https://doi.org/10.3390/ma15062248 (https://doi.org/10.3390/ma15062248)** - 18 Mar 2022

Open Access Article ☰ (/1996-1944/15/6/2247/pdf?version=1647823308)

An Experimental Investigation of Static Properties of Bio-Oils and SAE40 Oil in Journal Bearing Applications (/1996-1944/15/6/2247)

Materials **2022**, *15*(6), 2247; **https://doi.org/10.3390/ma15062247 (https://doi.org/10.3390/ma15062247)** - 18 Mar 2022

Open Access Article ☰ (/1996-1944/15/6/2246/pdf?version=1647589607)

A Preliminary In Vitro Study of 3D Full-Field Strain Distribution in Human Whole Premolars Using Digital Image Correlation (/1996-1944/15/6/2246)

Materials **2022**, *15*(6), 2246; **https://doi.org/10.3390/ma15062246 (https://doi.org/10.3390/ma15062246)** - 18 Mar 2022

Open Access Article ☰ (/1996-1944/15/6/2245/pdf?version=1647586420)

Preparation of Aluminum–Molybdenum Alloy Thin Film Oxide and Study of Molecular CO + NO Conversion on Its Surface (/1996-1944/15/6/2245)

Materials **2022**, *15*(6), 2245; **https://doi.org/10.3390/ma15062245 (https://doi.org/10.3390/ma15062245)** - 18 Mar 2022

Open Access Article ☰ (/1996-1944/15/6/2244/pdf?version=1647586223)

Magnetic Resonance Studies of Hybrid Nanocomposites Containing Nanocrystalline TiO_2 and Graphene-Related Materials (/1996-1944/15/6/2244)

Materials **2022**, *15*(6), 2244; **https://doi.org/10.3390/ma15062244 (https://doi.org/10.3390/ma15062244)** - 18 Mar 2022

Open Access Article ☰ (/1996-1944/15/6/2243/pdf?version=1647580960)

Fracture Behavior of Steel Slag Powder-Cement-Based Concrete with Different Steel-Slag-Powder Replacement Ratios (/1996-1944/15/6/2243)

Materials **2022**, *15*(6), 2243; **https://doi.org/10.3390/ma15062243 (https://doi.org/10.3390/ma15062243)** - 18 Mar 2022

Open Access Article (/1996-1944/15/6/2242/pdf?version=1647582123)

Research on Dewatering Characteristics of Waste Slurry from Pipe Jacking Construction (/1996-1944/15/6/2242)

Materials **2022**, *15*(6), 2242; https://doi.org/10.3390/ma15062242 (https://doi.org/10.3390/ma15062242) - 18 Mar 2022

Open Access Article (/1996-1944/15/6/2241/pdf?version=1647580767)

CVD-Synthesis of N-CNT Using Propane and Ammonia (/1996-1944/15/6/2241)

Materials **2022**, *15*(6), 2241; https://doi.org/10.3390/ma15062241 (https://doi.org/10.3390/ma15062241) - 18 Mar 2022

Open Access Article (/1996-1944/15/6/2240/pdf?version=1647571138)

Self-Powered and Flexible Triboelectric Sensors with Oblique Morphology towards Smart Swallowing Rehabilitation Monitoring System (/1996-1944/15/6/2240)

Materials **2022**, *15*(6), 2240; https://doi.org/10.3390/ma15062240 (https://doi.org/10.3390/ma15062240) - 18 Mar 2022

Open Access Article (/1996-1944/15/6/2239/pdf?version=1647534441)

A Semi-Analytical Solution for Shock Wave Pressure and Radius of Soil Plastic Zone Induced by Lightning Strikes (/1996-1944/15/6/2239)

Materials **2022**, *15*(6), 2239; https://doi.org/10.3390/ma15062239 (https://doi.org/10.3390/ma15062239) - 17 Mar 2022

Open Access Article (/1996-1944/15/6/2238/pdf?version=1647593735)

Powder Reuse in Laser-Based Powder Bed Fusion of Ti6Al4V—Changes in Mechanical Properties during a Powder Top-Up Regime (/1996-1944/15/6/2238)

Materials **2022**, *15*(6), 2238; https://doi.org/10.3390/ma15062238 (https://doi.org/10.3390/ma15062238) - 17 Mar 2022

Open Access Article (/1996-1944/15/6/2237/pdf?version=1647614278)

Improving Energy Harvesting from Bridge Vibration Excited by Moving Vehicles with a Bi-Stable Harvester (/1996-1944/15/6/2237)

Materials **2022**, *15*(6), 2237; https://doi.org/10.3390/ma15062237 (https://doi.org/10.3390/ma15062237) - 17 Mar 2022

Open Access Article (/1996-1944/15/6/2236/pdf?version=1647523563)

Tribological Behaviors of Super-Hard TiAlN Coatings Deposited by Filtered Cathode Vacuum Arc Deposition (/1996-1944/15/6/2236)

Materials **2022**, *15*(6), 2236; https://doi.org/10.3390/ma15062236 (https://doi.org/10.3390/ma15062236) - 17 Mar 2022

Open Access Article (/1996-1944/15/6/2235/pdf?version=1647522637)

Influence of GeO_2 Content on the Spectral and Radiation-Resistant Properties of Yb/Al/Ge Co-Doped Silica Fiber Core Glasses (/1996-1944/15/6/2235)

Materials **2022**, *15*(6), 2235; https://doi.org/10.3390/ma15062235 (https://doi.org/10.3390/ma15062235) - 17 Mar 2022

Open Access Article (/1996-1944/15/6/2234/pdf?version=1647605930)

The Fabrication of Porous Metal-Bonded Diamond Coatings Based on Low-Pressure Cold Spraying and Ni-Al Diffusion-Reaction (/1996-1944/15/6/2234)

Materials **2022**, *15*(6), 2234; https://doi.org/10.3390/ma15062234 (https://doi.org/10.3390/ma15062234) - 17 Mar 2022

Open Access Article (/1996-1944/15/6/2233/pdf?version=1647588413)

Masking Ability of Monolithic and Layered Zirconia Crowns on Discolored Substrates (/1996-1944/15/6/2233)

Materials **2022**, *15*(6), 2233; https://doi.org/10.3390/ma15062233 (https://doi.org/10.3390/ma15062233) - 17 Mar 2022

Open Access Article (/1996-1944/15/6/2232/pdf?version=1647565449)

Molecular Dynamics Simulation of Sintering Densification of Multi-Scale Silver Layer (/1996-1944/15/6/2232)

Materials **2022**, *15*(6), 2232; https://doi.org/10.3390/ma15062232 (https://doi.org/10.3390/ma15062232) - 17 Mar 2022

Open Access Article (/1996-1944/15/6/2231/pdf?version=1647521055)

Experimental Investigation on the Vertical Ductility of Rectangular CFST Columns Loaded Axially (/1996-1944/15/6/2231)

Materials **2022**, *15*(6), 2231; https://doi.org/10.3390/ma15062231 (https://doi.org/10.3390/ma15062231) - 17 Mar 2022

Open Access Article (/1996-1944/15/6/2230/pdf?version=1647935171)

Bone Union Quality after Fracture Fixation of Mandibular Head with Compression Magnesium Screws (/1996-1944/15/6/2230)

Materials **2022**, *15*(6), 2230; https://doi.org/10.3390/ma15062230 (https://doi.org/10.3390/ma15062230) - 17 Mar 2022

Open Access Review (/1996-1944/15/6/2229/pdf?version=1647578977)

Graphene-Oxide-Enriched Biomaterials: A Focus on Osteo and Chondroinductive Properties and Immunomodulation (/1996-1944/15/6/2229)

Materials **2022**, *15*(6), 2229; https://doi.org/10.3390/ma15062229 (https://doi.org/10.3390/ma15062229) - 17 Mar 2022

Open Access Communication (/1996-1944/15/6/2228/pdf?version=1648113404)

MDPI (/)

Cubic Iron Core–Shell Nanoparticles Functionalized to Obtain High-Performance MRI Contrast Agents (/1996-1944/15/6/2228)

Materials **2022**, *15*(6), 2228; https://doi.org/10.3390/ma15062228 (https://doi.org/10.3390/ma15062228) - 17 Mar 2022

(/toggle_desktop_layout_cookie)

Open Access Article (/1996-1944/15/6/2227/pdf?version=1647942551)

A New Failure Theory and Importance Measurement Analysis for Multidirectional Fiber-Reinforced Composite Laminates with Holes (/1996-1944/15/6/2227)

Materials **2022**, *15*(6), 2227; https://doi.org/10.3390/ma15062227 (https://doi.org/10.3390/ma15062227) - 17 Mar 2022

Open Access Article (/1996-1944/15/6/2226/pdf?version=1647515629)

Frost Resistance Investigation of Fiber-Doped Cementitious Composites (/1996-1944/15/6/2226)

Materials **2022**, *15*(6), 2226; https://doi.org/10.3390/ma15062226 (https://doi.org/10.3390/ma15062226) - 17 Mar 2022

Open Access Article (/1996-1944/15/6/2225/pdf?version=1647673672)

Attachment and Osteogenic Potential of Dental Pulp Stem Cells on Non-Thermal Plasma and UV Light Treated Titanium, Zirconia and Modified PEEK Surfaces (/1996-1944/15/6/2225)

Materials **2022**, *15*(6), 2225; https://doi.org/10.3390/ma15062225 (https://doi.org/10.3390/ma15062225) - 17 Mar 2022

Open Access Editor's Choice Article (/1996-1944/15/6/2224/pdf?version=1647931887)

Combined Electrochemical, Raman Analysis and Machine Learning Assessments of the Inhibitive Properties of an 1,3,4-Oxadiazole-2-Thiol Derivative against Carbon Steel Corrosion in HCl Solution (/1996-1944/15/6/2224)

Materials **2022**, *15*(6), 2224; https://doi.org/10.3390/ma15062224 (https://doi.org/10.3390/ma15062224) - 17 Mar 2022

Open Access Article (/1996-1944/15/6/2223/pdf?version=1647832630)

Effects of Underwater Friction Stir Welding Heat Generation on Residual Stress of AA6068-T6 Aluminum Alloy (/1996-1944/15/6/2223)

Materials **2022**, *15*(6), 2223; https://doi.org/10.3390/ma15062223 (https://doi.org/10.3390/ma15062223) - 17 Mar 2022

Open Access Article (/1996-1944/15/6/2222/pdf?version=1648018185)

Residual Compressive Behavior of Self-Compacting Concrete after High Temperature Exposure—Influence of Binder Materials (/1996-1944/15/6/2222)

Materials **2022**, *15*(6), 2222; https://doi.org/10.3390/ma15062222 (https://doi.org/10.3390/ma15062222) - 17 Mar 2022

Open Access Editor's Choice Review (/1996-1944/15/6/2221/pdf?version=1647577150)

Engineering 2D Materials for Photocatalytic Water-Splitting from a Theoretical Perspective (/1996-1944/15/6/2221)

Materials **2022**, *15*(6), 2221; https://doi.org/10.3390/ma15062221 (https://doi.org/10.3390/ma15062221) - 17 Mar 2022

Open Access Article (/1996-1944/15/6/2220/pdf?version=1647514988)

Reactive Powder Concrete Microstructure and Particle Packing (/1996-1944/15/6/2220)

Materials **2022**, *15*(6), 2220; https://doi.org/10.3390/ma15062220 (https://doi.org/10.3390/ma15062220) - 17 Mar 2022

Open Access Article (/1996-1944/15/6/2219/pdf?version=1647569990)

Electrically Switchable Film Structure of Conjugated Polymer Composites (/1996-1944/15/6/2219)

Materials **2022**, *15*(6), 2219; https://doi.org/10.3390/ma15062219 (https://doi.org/10.3390/ma15062219) - 17 Mar 2022

Open Access Communication (/1996-1944/15/6/2218/pdf?version=1647513313)

Removal of Thiol-SAM on a Gold Surface for Re-Use of an Interdigitated Chain-Shaped Electrode (/1996-1944/15/6/2218)

Materials **2022**, *15*(6), 2218; https://doi.org/10.3390/ma15062218 (https://doi.org/10.3390/ma15062218) - 17 Mar 2022

Open Access Article (/1996-1944/15/6/2217/pdf?version=1647514135)

Synthesis of In Situ ZrB_2-SiC-ZrC Coating on ZrC-SiC Substrate by Reactive Plasma Spraying (/1996-1944/15/6/2217)

Materials **2022**, *15*(6), 2217; https://doi.org/10.3390/ma15062217 (https://doi.org/10.3390/ma15062217) - 17 Mar 2022

Open Access Article (/1996-1944/15/6/2216/pdf?version=1647512897)

Composition of Corroded Reinforcing Steel Surface in Solutions Simulating the Electrolytic Environments in the Micropores of Concrete in the Propagation Period (/1996-1944/15/6/2216)

Materials **2022**, *15*(6), 2216; https://doi.org/10.3390/ma15062216 (https://doi.org/10.3390/ma15062216) - 17 Mar 2022

Open Access Article (/1996-1944/15/6/2215/pdf?version=1647512101)

The Effect of Heat Source Path on Thermal Evolution during Electro-Gas Welding of Thick Steel Plates (/1996-1944/15/6/2215)

Materials **2022**, *15*(6), 2215; https://doi.org/10.3390/ma15062215 (https://doi.org/10.3390/ma15062215) - 17 Mar 2022

Open Access Article (/1996-1944/15/6/2214/pdf?version=1647511635)

[Impact Abrasive Wear Property of CrAlN/TiSiN Multilayer Coating at Elevated Temperatures (/1996-1944/15/6/2214)](/1996-1944/15/6/2214)

Materials **2022**, *15*(6), 2214; **https://doi.org/10.3390/ma15062214 (https://doi.org/10.3390/ma15062214)** - 17 Mar 2022

Open Access Editor's Choice Article (/1996-1944/15/6/2213/pdf?version=1647509325)

[Plasmonically Enhanced Colloidal Quantum Dot/Graphene Doped Polymer Random Lasers (/1996-1944/15/6/2213)](/1996-1944/15/6/2213)

Materials **2022**, *15*(6), 2213; **https://doi.org/10.3390/ma15062213 (https://doi.org/10.3390/ma15062213)** - 17 Mar 2022

Open Access Article (/1996-1944/15/6/2212/pdf?version=1647505922)

[Effects of Inorganic Metabolites of Sulphate-Reducing Bacteria on the Corrosion of AZ31B and AZ63B Magnesium Alloy in 3.5 wt.% NaCl Solution (/1996-1944/15/6/2212)](/1996-1944/15/6/2212)

Materials **2022**, *15*(6), 2212; **https://doi.org/10.3390/ma15062212 (https://doi.org/10.3390/ma15062212)** - 17 Mar 2022

Open Access Article (/1996-1944/15/6/2211/pdf?version=1647506016)

[Effect of Carbon on Dislocation Loops Formation during Self-Ion Irradiation in Fe-Cr Alloys at High Temperatures (/1996-1944/15/6/2211)](/1996-1944/15/6/2211)

Materials **2022**, *15*(6), 2211; **https://doi.org/10.3390/ma15062211 (https://doi.org/10.3390/ma15062211)** - 17 Mar 2022

Open Access Article (/1996-1944/15/6/2210/pdf?version=1647503849)

[A Simplified Approach for the Corrosion Fatigue Assessment of Steel Structures in Aggressive Environments (/1996-1944/15/6/2210)](/1996-1944/15/6/2210)

Materials **2022**, *15*(6), 2210; **https://doi.org/10.3390/ma15062210 (https://doi.org/10.3390/ma15062210)** - 17 Mar 2022

Open Access Article (/1996-1944/15/6/2209/pdf?version=1647858368)

[Planar or Biaxial Stretching of Poly(ethylene terephthalate) Fiber Webs Prepared by Laser-Electrospinning (/1996-1944/15/6/2209)](/1996-1944/15/6/2209)

Materials **2022**, *15*(6), 2209; **https://doi.org/10.3390/ma15062209 (https://doi.org/10.3390/ma15062209)** - 17 Mar 2022

Open Access Editorial (/1996-1944/15/6/2208/pdf?version=1647506530)

[Measurement of the Environmental Impact of Materials (/1996-1944/15/6/2208)](/1996-1944/15/6/2208)

Materials **2022**, *15*(6), 2208; **https://doi.org/10.3390/ma15062208 (https://doi.org/10.3390/ma15062208)** - 17 Mar 2022

Open Access Article (/1996-1944/15/6/2207/pdf?version=1647493925)

[pH and Redox Dual-Responsive Mesoporous Silica Nanoparticle as Nanovehicle for Improving Fungicidal Efficiency (/1996-1944/15/6/2207)](/1996-1944/15/6/2207)

Materials **2022**, *15*(6), 2207; **https://doi.org/10.3390/ma15062207 (https://doi.org/10.3390/ma15062207)** - 17 Mar 2022

Open Access Article (/1996-1944/15/6/2206/pdf?version=1647480261)

[Effect of Preparation Method on the Catalytic Performance of HZSM-5 Zeolite Catalysts in the MTH Reaction (/1996-1944/15/6/2206)](/1996-1944/15/6/2206)

Materials **2022**, *15*(6), 2206; **https://doi.org/10.3390/ma15062206 (https://doi.org/10.3390/ma15062206)** - 17 Mar 2022

Open Access Article (/1996-1944/15/6/2205/pdf?version=1647446496)

[Parametric Optimization for Quality of Electric Discharge Machined Profile by Using Multi-Shape Electrode (/1996-1944/15/6/2205)](/1996-1944/15/6/2205)

Materials **2022**, *15*(6), 2205; **https://doi.org/10.3390/ma15062205 (https://doi.org/10.3390/ma15062205)** - 16 Mar 2022

Open Access Article (/1996-1944/15/6/2204/pdf?version=1647566300)

[Characterization of Microstructure, Phase Composition, and Mechanical Behavior of Ballistic Steels (/1996-1944/15/6/2204)](/1996-1944/15/6/2204)

Materials **2022**, *15*(6), 2204; **https://doi.org/10.3390/ma15062204 (https://doi.org/10.3390/ma15062204)** - 16 Mar 2022

Open Access Review (/1996-1944/15/6/2203/pdf?version=1648049542)

[Graphene as a Transparent Conductive Electrode in GaN-Based LEDs (/1996-1944/15/6/2203)](/1996-1944/15/6/2203)

Materials **2022**, *15*(6), 2203; **https://doi.org/10.3390/ma15062203 (https://doi.org/10.3390/ma15062203)** - 16 Mar 2022

Open Access Article (/1996-1944/15/6/2202/pdf?version=1647497726)

[A Comparative Study on Simulated Chairside Grinding and Polishing of Monolithic Zirconia (/1996-1944/15/6/2202)](/1996-1944/15/6/2202)

Materials **2022**, *15*(6), 2202; **https://doi.org/10.3390/ma15062202 (https://doi.org/10.3390/ma15062202)** - 16 Mar 2022

Open Access Article (/1996-1944/15/6/2201/pdf?version=1648006083)

[Wide-Oblique-Incident-Angle Stable Polarization-Insensitive Ultra-Wideband Metamaterial Perfect Absorber for Visible Optical Wavelength Applications (/1996-1944/15/6/2201)](/1996-1944/15/6/2201)

Materials **2022**, *15*(6), 2201; **https://doi.org/10.3390/ma15062201 (https://doi.org/10.3390/ma15062201)** - 16 Mar 2022

Open Access Article (/1996-1944/15/6/2200/pdf?version=1650852306)

[Novel Composite Nitride Nanoceramics from Reaction-Mixed Nanocrystalline Powders in the System Aluminum Nitride AlN/Gallium Nitride GaN/Titanium Nitride TiN (Al:Ga:Ti = 1:1:1) (/1996-1944/15/6/2200)

Materials **2022**, *15*(6), 2200; **https://doi.org/10.3390/ma15062200 (https://doi.org/10.3390/ma15062200)** - 16 Mar 2022

Open Access Article (/1996-1944/15/6/2199/pdf?version=1647512567)

Preparation and Strength Formation Mechanism of Calcined Oyster Shell, Red Mud, Slag, and Iron Tailing Composite Cemented Paste Backfill (/1996-1944/15/6/2199)

Materials **2022**, *15*(6), 2199; **https://doi.org/10.3390/ma15062199 (https://doi.org/10.3390/ma15062199)** - 16 Mar 2022

Open Access Review (/1996-1944/15/6/2198/pdf?version=1648628207)

A Review of Binderless Polycrystalline Diamonds: Focus on the High-Pressure–High-Temperature Sintering Process (/1996-1944/15/6/2198)

Materials **2022**, *15*(6), 2198; **https://doi.org/10.3390/ma15062198 (https://doi.org/10.3390/ma15062198)** - 16 Mar 2022

Open Access Article (/1996-1944/15/6/2197/pdf?version=1647521642)

Evaluation of the Effect of Selected Physiological Fluid Contaminants on the Mechanical Properties of Selected Medium-Viscosity PMMA Bone Cements (/1996-1944/15/6/2197)

Materials **2022**, *15*(6), 2197; **https://doi.org/10.3390/ma15062197 (https://doi.org/10.3390/ma15062197)** - 16 Mar 2022

Open Access Communication (/1996-1944/15/6/2196/pdf?version=1647433658)

Interfacial Deposition of Titanium Dioxide at the Polarized Liquid–Liquid Interface (/1996-1944/15/6/2196)

Materials **2022**, *15*(6), 2196; **https://doi.org/10.3390/ma15062196 (https://doi.org/10.3390/ma15062196)** - 16 Mar 2022

Open Access Article (/1996-1944/15/6/2195/pdf?version=1647431532)

Early Immune Response in Foreign Body Reaction Is Implant/Material Specific (/1996-1944/15/6/2195)

Materials **2022**, *15*(6), 2195; **https://doi.org/10.3390/ma15062195 (https://doi.org/10.3390/ma15062195)** - 16 Mar 2022

Open Access Review (/1996-1944/15/6/2194/pdf?version=1648032046)

Bioactive Glasses in Periodontal Regeneration: Existing Strategies and Future Prospects—A Literature Review (/1996-1944/15/6/2194)

Materials **2022**, *15*(6), 2194; **https://doi.org/10.3390/ma15062194 (https://doi.org/10.3390/ma15062194)** - 16 Mar 2022

Open Access Article (/1996-1944/15/6/2193/pdf?version=1647488241)

Application of X-ray Computed Tomography to Verify Bond Failures Mechanism of Fiber-Reinforced Fine-Grain Concrete (/1996-1944/15/6/2193)

Materials **2022**, *15*(6), 2193; **https://doi.org/10.3390/ma15062193 (https://doi.org/10.3390/ma15062193)** - 16 Mar 2022

Open Access Article (/1996-1944/15/6/2192/pdf?version=1647430680)

Hydration Processes of Four-Component Binders Containing a Low Amount of Cement (/1996-1944/15/6/2192)

Materials **2022**, *15*(6), 2192; **https://doi.org/10.3390/ma15062192 (https://doi.org/10.3390/ma15062192)** - 16 Mar 2022

Open Access Article (/1996-1944/15/6/2191/pdf?version=1647431075)

Characteristics of Vibrating Fluidization and Transportation for Al_2O_3 Powder (/1996-1944/15/6/2191)

Materials **2022**, *15*(6), 2191; **https://doi.org/10.3390/ma15062191 (https://doi.org/10.3390/ma15062191)** - 16 Mar 2022

Open Access Article (/1996-1944/15/6/2190/pdf?version=1647430075)

Study on the Effects of Different Cutting Angles on the End-Milling of Wire and Arc Additive Manufacturing Inconel 718 Workpieces (/1996-1944/15/6/2190)

Materials **2022**, *15*(6), 2190; **https://doi.org/10.3390/ma15062190 (https://doi.org/10.3390/ma15062190)** - 16 Mar 2022

Open Access Article (/1996-1944/15/6/2189/pdf?version=1647428950)

Spatio-Temporal Statistical Characterization of Boundary Kinematic Phenomena of Triaxial Sand Specimens (/1996-1944/15/6/2189)

Materials **2022**, *15*(6), 2189; **https://doi.org/10.3390/ma15062189 (https://doi.org/10.3390/ma15062189)** - 16 Mar 2022

Open Access Article (/1996-1944/15/6/2188/pdf?version=1647433636)

Mechanism Analysis of Rock Failure Process under High-Voltage Electropulse: Analytical Solution and Simulation (/1996-1944/15/6/2188)

Materials **2022**, *15*(6), 2188; **https://doi.org/10.3390/ma15062188 (https://doi.org/10.3390/ma15062188)** - 16 Mar 2022

Open Access Article (/1996-1944/15/6/2187/pdf?version=1647488561)

Turning Copper and Aluminum Alloys with Natural Rocks as Cutting Tools (/1996-1944/15/6/2187)

Materials **2022**, *15*(6), 2187; **https://doi.org/10.3390/ma15062187 (https://doi.org/10.3390/ma15062187)** - 16 Mar 2022

Open Access Article (/1996-1944/15/6/2186/pdf?version=1647571105)

MDPI (/)

[Adhesion of Different Resin Cements to Zirconia: Effect of Incremental versus Bulk Build Up, Use of Mould and Ageing (/1996-1944/15/6/2186)](/1996-1944/15/6/2186)

(/toggle_desktop_layout_cookie)

Materials **2022**, *15*(6), 2186; **https://doi.org/10.3390/ma15062186 (https://doi.org/10.3390/ma15062186)** - 16 Mar 2022

Open Access Article (/1996-1944/15/6/2185/pdf?version=1647427741)

Influence of Film Coating Thickness on Secondary Electron Emission Characteristics of Non-Evaporable Getter Ti-Hf-V-Zr Coated Open-Cell Copper Foam Substrates (/1996-1944/15/6/2185)

Materials **2022**, *15*(6), 2185; **https://doi.org/10.3390/ma15062185 (https://doi.org/10.3390/ma15062185)** - 16 Mar 2022

Open Access Review (/1996-1944/15/6/2184/pdf?version=1647424733)

A Brief Review on Factors Affecting the Tribological Interaction between Human Skin and Different Textile Materials (/1996-1944/15/6/2184)

Materials **2022**, *15*(6), 2184; **https://doi.org/10.3390/ma15062184 (https://doi.org/10.3390/ma15062184)** - 16 Mar 2022

Open Access Article (/1996-1944/15/6/2183/pdf?version=1650966681)

Biocompatible Materials for Orbital Wall Reconstruction—An Overview (/1996-1944/15/6/2183)

Materials **2022**, *15*(6), 2183; **https://doi.org/10.3390/ma15062183 (https://doi.org/10.3390/ma15062183)** - 16 Mar 2022

Open Access Article (/1996-1944/15/6/2182/pdf?version=1647419983)

Molybdenum Oxide Nanoparticle Aggregates Grown by Chemical Vapor Transport (/1996-1944/15/6/2182)

Materials **2022**, *15*(6), 2182; **https://doi.org/10.3390/ma15062182 (https://doi.org/10.3390/ma15062182)** - 16 Mar 2022

Open Access Article (/1996-1944/15/6/2181/pdf?version=1647941010)

Efficient Use of Graphene Oxide in Layered Cement Mortar (/1996-1944/15/6/2181)

Materials **2022**, *15*(6), 2181; **https://doi.org/10.3390/ma15062181 (https://doi.org/10.3390/ma15062181)** - 16 Mar 2022

Open Access Article (/1996-1944/15/6/2180/pdf?version=1647411133)

0D/2D Mixed Dimensional Lead-Free Caesium Bismuth Iodide Perovskite for Solar Cell Application (/1996-1944/15/6/2180)

Materials **2022**, *15*(6), 2180; **https://doi.org/10.3390/ma15062180 (https://doi.org/10.3390/ma15062180)** - 16 Mar 2022

Open Access Article (/1996-1944/15/6/2179/pdf?version=1647416294)

Large-Scale Fabrication of Graded Convex Structure for Superhydrophobic Coating Inspired by Nature (/1996-1944/15/6/2179)

Materials **2022**, *15*(6), 2179; **https://doi.org/10.3390/ma15062179 (https://doi.org/10.3390/ma15062179)** - 16 Mar 2022

Open Access Editorial (/1996-1944/15/6/2178/pdf?version=1647404142)

The Nature of the Passive Layer (and Spalled Corrosion Products) on Nonferrous Alloys in Aqueous Corrosive Media—Editorial (/1996-1944/15/6/2178)

Materials **2022**, *15*(6), 2178; **https://doi.org/10.3390/ma15062178 (https://doi.org/10.3390/ma15062178)** - 16 Mar 2022

Open Access Article (/1996-1944/15/6/2157/pdf?version=1647404283)

Effect of Deformation on the Corrosion Behavior of Friction Stir Welded Joints of 2024 Aluminum Alloy (/1996-1944/15/6/2157)

Materials **2022**, *15*(6), 2157; **https://doi.org/10.3390/ma15062157 (https://doi.org/10.3390/ma15062157)** - 16 Mar 2022

Open Access Article (/1996-1944/15/6/2177/pdf?version=1647514798)

Structure and Photoluminescence Properties of Dy^{3+} Doped Phosphor with Whitlockite Structure (/1996-1944/15/6/2177)

Materials **2022**, *15*(6), 2177; **https://doi.org/10.3390/ma15062177 (https://doi.org/10.3390/ma15062177)** - 15 Mar 2022

Open Access Article (/1996-1944/15/6/2176/pdf?version=1647961810)

Adsorption of Inositol Phosphate on Hydroxyapatite Powder with High Specific Surface Area (/1996-1944/15/6/2176)

Materials **2022**, *15*(6), 2176; **https://doi.org/10.3390/ma15062176 (https://doi.org/10.3390/ma15062176)** - 15 Mar 2022

Open Access Article (/1996-1944/15/6/2175/pdf?version=1647349665)

Analytical Solution for Forced Vibration Characteristics of Rotating Functionally Graded Blades under Rub-Impact and Base Excitation (/1996-1944/15/6/2175)

Materials **2022**, *15*(6), 2175; **https://doi.org/10.3390/ma15062175 (https://doi.org/10.3390/ma15062175)** - 15 Mar 2022

Open Access Article (/1996-1944/15/6/2174/pdf?version=1647499411)

Colour Change of Sustainable Concrete Containing Waste Ceramic and Hybrid Fibre: Effect of Temperature (/1996-1944/15/6/2174)

Materials **2022**, *15*(6), 2174; **https://doi.org/10.3390/ma15062174 (https://doi.org/10.3390/ma15062174)** - 15 Mar 2022

Open Access Article ≡ (/1996-1944/15/6/2173/pdf?version=1647393980)

MDPI (/)

[Mechanical Properties and Gamma Radiation Transmission Rate of Heavyweight Concrete Containing Barite Aggregates (/1996-1944/15/6/2173)](/1996-1944/15/6/2173)

(/toggle_desktop_layout_cookie)

Materials **2022**, *15*(6), 2173; **https://doi.org/10.3390/ma15062173 (https://doi.org/10.3390/ma15062173)** - 15 Mar 2022

Open Access Review ≡ (/1996-1944/15/6/2172/pdf?version=1647349844)

Biodegradable Mg–Zn–Ca-Based Metallic Glasses (/1996-1944/15/6/2172)

Materials **2022**, *15*(6), 2172; **https://doi.org/10.3390/ma15062172 (https://doi.org/10.3390/ma15062172)** - 15 Mar 2022

Open Access Editor's Choice Article ≡ (/1996-1944/15/6/2171/pdf?version=1647420303)

Polyester and Epoxy Resins with Increased Thermal Conductivity and Reduced Surface Resistivity for Applications in Explosion-Proof Enclosures of Electrical Devices (/1996-1944/15/6/2171)

Materials **2022**, *15*(6), 2171; **https://doi.org/10.3390/ma15062171 (https://doi.org/10.3390/ma15062171)** - 15 Mar 2022

Open Access Editor's Choice Article ≡ (/1996-1944/15/6/2170/pdf?version=1647417819)

The Effects of 3-Dimensional Bioprinting Calcium Silicate Cement/Methacrylated Gelatin Scaffold on the Proliferation and Differentiation of Human Dental Pulp Stem Cells (/1996-1944/15/6/2170)

Materials **2022**, *15*(6), 2170; **https://doi.org/10.3390/ma15062170 (https://doi.org/10.3390/ma15062170)** - 15 Mar 2022

Open Access Article ≡ (/1996-1944/15/6/2169/pdf?version=1647346297)

Synthesis of Si-Modified Pseudo-Boehmite@kaolin Composite and Its Application as a Novel Matrix Material for FCC Catalyst (/1996-1944/15/6/2169)

Materials **2022**, *15*(6), 2169; **https://doi.org/10.3390/ma15062169 (https://doi.org/10.3390/ma15062169)** - 15 Mar 2022

Open Access Article ≡ (/1996-1944/15/6/2168/pdf?version=1647434225)

Novel Mixing Relations for Determining the Effective Thermal Conductivity of Open-Cell Foams (/1996-1944/15/6/2168)

Materials **2022**, *15*(6), 2168; **https://doi.org/10.3390/ma15062168 (https://doi.org/10.3390/ma15062168)** - 15 Mar 2022

Open Access Article ≡ (/1996-1944/15/6/2167/pdf?version=1647343895)

Investigation of the Densification Behavior of Alumina during Spark Plasma Sintering (/1996-1944/15/6/2167)

Materials **2022**, *15*(6), 2167; **https://doi.org/10.3390/ma15062167 (https://doi.org/10.3390/ma15062167)** - 15 Mar 2022

Open Access Article ≡ (/1996-1944/15/6/2166/pdf?version=1647345059)

Nickel-Containing Perovskites, $PrNi_{0.4}Fe_{0.6}O_{3-\delta}$ and $PrNi_{0.4}Co_{0.6}O_{3-\delta}$, as Potential Electrodes for Protonic Ceramic Electrochemical Cells (/1996-1944/15/6/2166)

Materials **2022**, *15*(6), 2166; **https://doi.org/10.3390/ma15062166 (https://doi.org/10.3390/ma15062166)** - 15 Mar 2022

Open Access Article ≡ (/1996-1944/15/6/2165/pdf?version=1647342267)

Thermal and Mechanical Properties of Amorphous Silicon Carbide Thin Films Using the Femtosecond Pump-Probe Technique (/1996-1944/15/6/2165)

Materials **2022**, *15*(6), 2165; **https://doi.org/10.3390/ma15062165 (https://doi.org/10.3390/ma15062165)** - 15 Mar 2022

Open Access Review ≡ (/1996-1944/15/6/2164/pdf?version=1647342616)

Progress in the Development of Graphene-Based Biomaterials for Tissue Engineering and Regeneration (/1996-1944/15/6/2164)

Materials **2022**, *15*(6), 2164; **https://doi.org/10.3390/ma15062164 (https://doi.org/10.3390/ma15062164)** - 15 Mar 2022

Open Access Article ≡ (/1996-1944/15/6/2163/pdf?version=1647342424)

Effects of Air Entrainment on Bacterial Viability in Cement Paste (/1996-1944/15/6/2163)

Materials **2022**, *15*(6), 2163; **https://doi.org/10.3390/ma15062163 (https://doi.org/10.3390/ma15062163)** - 15 Mar 2022

Open Access Article ≡ (/1996-1944/15/6/2162/pdf?version=1647347166)

Effect of Intercritical Tempering Temperature on Microstructure Evolution and Mechanical Properties of High Strength and Toughness Medium Manganese Steel (/1996-1944/15/6/2162)

Materials **2022**, *15*(6), 2162; **https://doi.org/10.3390/ma15062162 (https://doi.org/10.3390/ma15062162)** - 15 Mar 2022

Open Access Article ≡ (/1996-1944/15/6/2161/pdf?version=1647342055)

Proteomics Disclose the Potential of Gingival Crevicular Fluid (GCF) as a Source of Biomarkers for Severe Periodontitis (/1996-1944/15/6/2161)

Materials **2022**, *15*(6), 2161; **https://doi.org/10.3390/ma15062161 (https://doi.org/10.3390/ma15062161)** - 15 Mar 2022

Open Access Editor's Choice Review ≡ (/1996-1944/15/6/2160/pdf?version=1647409490)

Exploring the Journey of Zinc Oxide Nanoparticles (ZnO-NPs) toward Biomedical Applications (/1996-1944/15/6/2160)

Materials **2022**, *15*(6), 2160; **https://doi.org/10.3390/ma15062160 (https://doi.org/10.3390/ma15062160)** - 15 Mar 2022

Open Access Article (/1996-1944/15/6/2159/pdf?version=1647424231)

Structural Fire Performance of Concrete-Filled Built-Up Cold-Formed Steel Columns (/1996-1944/15/6/2159)

Materials **2022**, *15*(6), 2159; **https://doi.org/10.3390/ma15062159 (https://doi.org/10.3390/ma15062159)** - 15 Mar 2022

Open Access Article (/1996-1944/15/6/2158/pdf?version=1648007755)

Microstructure and Mechanical Properties of Ti-25Nb-4Ta-8Sn Alloy Prepared by Spark Plasma Sintering (/1996-1944/15/6/2158)

Materials **2022**, *15*(6), 2158; **https://doi.org/10.3390/ma15062158 (https://doi.org/10.3390/ma15062158)** - 15 Mar 2022

Open Access Article (/1996-1944/15/6/2156/pdf?version=1647339861)

Effect of Residual Stresses on Fatigue Crack Growth: A Numerical Study Based on Cumulative Plastic Strain at the Crack Tip (/1996-1944/15/6/2156)

Materials **2022**, *15*(6), 2156; **https://doi.org/10.3390/ma15062156 (https://doi.org/10.3390/ma15062156)** - 15 Mar 2022

Open Access Article (/1996-1944/15/6/2155/pdf?version=1647338321)

Porous Coatings to Control Release Rates of Essential Oils to Generate an Atmosphere with Botanical Actives (/1996-1944/15/6/2155)

Materials **2022**, *15*(6), 2155; **https://doi.org/10.3390/ma15062155 (https://doi.org/10.3390/ma15062155)** - 15 Mar 2022

Open Access Article (/1996-1944/15/6/2154/pdf?version=1647403169)

Study on the Properties and Structure of Rotationally Moulded Linear Low-Density Polyethylene Filled with Quartz Flour (/1996-1944/15/6/2154)

Materials **2022**, *15*(6), 2154; **https://doi.org/10.3390/ma15062154 (https://doi.org/10.3390/ma15062154)** - 15 Mar 2022

Open Access Review (/1996-1944/15/6/2153/pdf?version=1647337346)

Advances in Material Nanosensitization: Refractive Property Changes as the Main Parameter to Indicate Organic Material Physical–Chemical Feature Improvements (/1996-1944/15/6/2153)

Materials **2022**, *15*(6), 2153; **https://doi.org/10.3390/ma15062153 (https://doi.org/10.3390/ma15062153)** - 15 Mar 2022

Open Access Article (/1996-1944/15/6/2152/pdf?version=1647336558)

Simulation Study on Coil of Biomass Carbonization Kettle (/1996-1944/15/6/2152)

Materials **2022**, *15*(6), 2152; **https://doi.org/10.3390/ma15062152 (https://doi.org/10.3390/ma15062152)** - 15 Mar 2022

Open Access Article (/1996-1944/15/6/2151/pdf?version=1647338201)

Predicting Mechanical Properties of Cold-Rolled Steel Strips Using Micro-Magnetic NDT Technologies (/1996-1944/15/6/2151)

Materials **2022**, *15*(6), 2151; **https://doi.org/10.3390/ma15062151 (https://doi.org/10.3390/ma15062151)** - 15 Mar 2022

Open Access Article (/1996-1944/15/6/2150/pdf?version=1647407778)

Retrospective Long-Term Clinical Outcome of Feldspathic Ceramic Veneers (/1996-1944/15/6/2150)

Materials **2022**, *15*(6), 2150; **https://doi.org/10.3390/ma15062150 (https://doi.org/10.3390/ma15062150)** - 15 Mar 2022

Open Access Article (/1996-1944/15/6/2149/pdf?version=1647333834)

Optimal Design of Double-Walled Corrugated Board Packaging (/1996-1944/15/6/2149)

Materials **2022**, *15*(6), 2149; **https://doi.org/10.3390/ma15062149 (https://doi.org/10.3390/ma15062149)** - 15 Mar 2022

Open Access Article (/1996-1944/15/6/2148/pdf?version=1647329663)

Molecular Dynamics Simulation and Structure Changes of Polyester in Water and Non-Aqueous Solvents (/1996-1944/15/6/2148)

Materials **2022**, *15*(6), 2148; **https://doi.org/10.3390/ma15062148 (https://doi.org/10.3390/ma15062148)** - 15 Mar 2022

Open Access Article (/1996-1944/15/6/2147/pdf?version=1647426999)

Manufacturing of Open-Cell Aluminium Foams: Comparing the Sponge Replication Technique and Its Combination with the Freezing Method (/1996-1944/15/6/2147)

Materials **2022**, *15*(6), 2147; **https://doi.org/10.3390/ma15062147 (https://doi.org/10.3390/ma15062147)** - 15 Mar 2022

Open Access Article (/1996-1944/15/6/2146/pdf?version=1647323526)

Reduction of Capacity Fading in High-Voltage NMC Batteries with the Addition of Reduced Graphene Oxide (/1996-1944/15/6/2146)

Materials **2022**, *15*(6), 2146; **https://doi.org/10.3390/ma15062146 (https://doi.org/10.3390/ma15062146)** - 15 Mar 2022

Open Access Article (/1996-1944/15/6/2145/pdf?version=1647323092)

Plasmon Tuning of Liquid Gallium Nanoparticles through Surface Anodization (/1996-1944/15/6/2145)

Materials 2022, 15(6), 2145; https://doi.org/10.3390/ma15062145 (https://doi.org/10.3390/ma15062145) - 15 Mar 2022

Open Access Article (/1996-1944/15/6/2144/pdf?version=1647773863)

Capabilities of Grazing Incidence X-ray Diffraction in the Investigation of Amorphous Mixed Oxides with Variable Composition (/1996-1944/15/6/2144)

Materials 2022, 15(6), 2144; https://doi.org/10.3390/ma15062144 (https://doi.org/10.3390/ma15062144) - 15 Mar 2022

Open Access Article (/1996-1944/15/6/2143/pdf?version=1647570345)

Impedance and Dielectric Properties of PVC:NH_4I Solid Polymer Electrolytes (SPEs): Steps toward the Fabrication of SPEs with High Resistivity (/1996-1944/15/6/2143)

Materials 2022, 15(6), 2143; https://doi.org/10.3390/ma15062143 (https://doi.org/10.3390/ma15062143) - 15 Mar 2022

Open Access Article (/1996-1944/15/6/2142/pdf?version=1648018348)

Development of Composite, Reinforced, Highly Drug-Loaded Pharmaceutical Printlets Manufactured by Selective Laser Sintering—In Search of Relevant Excipients for Pharmaceutical 3D Printing (/1996-1944/15/6/2142)

Materials 2022, 15(6), 2142; https://doi.org/10.3390/ma15062142 (https://doi.org/10.3390/ma15062142) - 14 Mar 2022

Open Access Article (/1996-1944/15/6/2141/pdf?version=1648035933)

On-Demand Wettability via Combining fs Laser Surface Structuring and Thermal Post-Treatment (/1996-1944/15/6/2141)

Materials 2022, 15(6), 2141; https://doi.org/10.3390/ma15062141 (https://doi.org/10.3390/ma15062141) - 14 Mar 2022

Open Access Review (/1996-1944/15/6/2140/pdf?version=1647339544)

Industry 4.0 and Digitalisation in Healthcare (/1996-1944/15/6/2140)

Materials 2022, 15(6), 2140; https://doi.org/10.3390/ma15062140 (https://doi.org/10.3390/ma15062140) - 14 Mar 2022

Open Access Communication (/1996-1944/15/6/2139/pdf?version=1648025711)

Biofilm on Toothbrushes of Children with Cystic Fibrosis: A Potential Source of Lung Re-Infection after Antibiotic Treatment? (/1996-1944/15/6/2139)

Materials 2022, 15(6), 2139; https://doi.org/10.3390/ma15062139 (https://doi.org/10.3390/ma15062139) - 14 Mar 2022

Open Access Article (/1996-1944/15/6/2138/pdf?version=1647922851)

Compaction Characteristics and Permeability of Expansive Shale Stabilized with Locally Produced Waste Materials (/1996-1944/15/6/2138)

Materials 2022, 15(6), 2138; https://doi.org/10.3390/ma15062138 (https://doi.org/10.3390/ma15062138) - 14 Mar 2022

Open Access Article (/1996-1944/15/6/2137/pdf?version=1647268663)

Resistance to High-Temperature Oxidation of Ti-Al-Nb Alloys (/1996-1944/15/6/2137)

Materials 2022, 15(6), 2137; https://doi.org/10.3390/ma15062137 (https://doi.org/10.3390/ma15062137) - 14 Mar 2022

Open Access Article (/1996-1944/15/6/2136/pdf?version=1647264124)

Effect of Heat Treatment on Tensile Properties and Microstructure of Co-Free, Low Ni-10 Mo-1.2 Ti Maraging Steel (/1996-1944/15/6/2136)

Materials 2022, 15(6), 2136; https://doi.org/10.3390/ma15062136 (https://doi.org/10.3390/ma15062136) - 14 Mar 2022

Open Access Article (/1996-1944/15/6/2135/pdf?version=1647413827)

Eliminating the Brittleness Constituent to Enhance Toughness of the High-Strength Steel Weld Heat-Affected Zone Using Electropulsing (/1996-1944/15/6/2135)

Materials 2022, 15(6), 2135; https://doi.org/10.3390/ma15062135 (https://doi.org/10.3390/ma15062135) - 14 Mar 2022

Open Access Article (/1996-1944/15/6/2134/pdf?version=1647336919)

Net Optical Gain Coefficients of Cu^+ and Tm^{3+} Single-Doped and Co-Doped Germanate Glasses (/1996-1944/15/6/2134)

Materials 2022, 15(6), 2134; https://doi.org/10.3390/ma15062134 (https://doi.org/10.3390/ma15062134) - 14 Mar 2022

Open Access Editor's Choice Article (/1996-1944/15/6/2133/pdf?version=1647257999)

Activated Carbon Preparation from Sugarcane Leaf via a Low Temperature Hydrothermal Process for Aquaponic Treatment (/1996-1944/15/6/2133)

Materials 2022, 15(6), 2133; https://doi.org/10.3390/ma15062133 (https://doi.org/10.3390/ma15062133) - 14 Mar 2022

Open Access Article (/1996-1944/15/6/2132/pdf?version=1647330367)

Research on Mechanical Properties and Influencing Factors of Cement-Graded Crushed Stone Using Vertical Vibration Compaction (/1996-1944/15/6/2132)

Materials 2022, 15(6), 2132; https://doi.org/10.3390/ma15062132 (https://doi.org/10.3390/ma15062132) - 14 Mar 2022

Open Access Article (/1996-1944/15/6/2131/pdf?version=1647333769)

[Prediction of the Non-Isothermal Austenitization Kinetics of Fe-C-Cr Low Alloy Steels with Lamellar Pearlite Microstructure (/1996-1944/15/6/2131)]

Materials **2022**, *15*(6), 2131; https://doi.org/10.3390/ma15062131 (https://doi.org/10.3390/ma15062131) - 14 Mar 2022

Open Access Article (/1996-1944/15/6/2130/pdf?version=1647254461)

Biomedical Ti-Nb-Zr Foams Prepared by Means of Thermal Dealloying Process and Electrochemical Modification (/1996-1944/15/6/2130)

Materials **2022**, *15*(6), 2130; https://doi.org/10.3390/ma15062130 (https://doi.org/10.3390/ma15062130) - 14 Mar 2022

Open Access Review (/1996-1944/15/6/2129/pdf?version=1647254319)

A Review of Ultrafine-Grained Magnetic Materials Prepared by Using High-Pressure Torsion Method (/1996-1944/15/6/2129)

Materials **2022**, *15*(6), 2129; https://doi.org/10.3390/ma15062129 (https://doi.org/10.3390/ma15062129) - 14 Mar 2022

Open Access Article (/1996-1944/15/6/2128/pdf?version=1647252930)

A Support Vector Machine and Particle Swarm Optimization Based Model for Cemented Tailings Backfill Materials Strength Prediction (/1996-1944/15/6/2128)

Materials **2022**, *15*(6), 2128; https://doi.org/10.3390/ma15062128 (https://doi.org/10.3390/ma15062128) - 14 Mar 2022

Open Access Article (/1996-1944/15/6/2127/pdf?version=1647256729)

Establishment of Analytical Model for CFRP Cutting Force Considering the Radius of the Edge Circle (/1996-1944/15/6/2127)

Materials **2022**, *15*(6), 2127; https://doi.org/10.3390/ma15062127 (https://doi.org/10.3390/ma15062127) - 14 Mar 2022

Open Access Article (/1996-1944/15/6/2126/pdf?version=1647430142)

Orodispersible Films with Rupatadine Fumarate Enclosed in Ethylcellulose Microparticles as Drug Delivery Platform with Taste-Masking Effect (/1996-1944/15/6/2126)

Materials **2022**, *15*(6), 2126; https://doi.org/10.3390/ma15062126 (https://doi.org/10.3390/ma15062126) - 14 Mar 2022

Open Access Article (/1996-1944/15/6/2125/pdf?version=1647251311)

Effectiveness of Ternary Blend Incorporating Rice Husk Ash, Silica Fume, and Cement in Preparing ASR Resilient Concrete (/1996-1944/15/6/2125)

Materials **2022**, *15*(6), 2125; https://doi.org/10.3390/ma15062125 (https://doi.org/10.3390/ma15062125) - 14 Mar 2022

Open Access Article (/1996-1944/15/6/2124/pdf?version=1647249692)

Characterization of Fractal Structures by Spray Flame Synthesis Using X-ray Scattering (/1996-1944/15/6/2124)

Materials **2022**, *15*(6), 2124; https://doi.org/10.3390/ma15062124 (https://doi.org/10.3390/ma15062124) - 14 Mar 2022

Open Access Article (/1996-1944/15/6/2123/pdf?version=1647401997)

Laboratory and Field Performance Evaluation of High-Workability Ultra-Thin Asphalt Overlays (/1996-1944/15/6/2123)

Materials **2022**, *15*(6), 2123; https://doi.org/10.3390/ma15062123 (https://doi.org/10.3390/ma15062123) - 14 Mar 2022

Open Access Editorial (/1996-1944/15/6/2122/pdf?version=1647233915)

Editorial for the Special Issue on “Fundamentals of Adsorbents–Synthesis, Characterization, Properties, and Application” (/1996-1944/15/6/2122)

Materials **2022**, *15*(6), 2122; https://doi.org/10.3390/ma15062122 (https://doi.org/10.3390/ma15062122) - 14 Mar 2022

Open Access Article (/1996-1944/15/6/2121/pdf?version=1647501590)

Long-Term Clearance and Biodistribution of Magnetic Nanoparticles Assessed by AC Biosusceptometry (/1996-1944/15/6/2121)

Materials **2022**, *15*(6), 2121; https://doi.org/10.3390/ma15062121 (https://doi.org/10.3390/ma15062121) - 14 Mar 2022

Open Access Article (/1996-1944/15/6/2120/pdf?version=1647330403)

Chemical Vapour Deposition of Scandia-Stabilised Zirconia Layers on Tubular Substrates at Low Temperatures (/1996-1944/15/6/2120)

Materials **2022**, *15*(6), 2120; https://doi.org/10.3390/ma15062120 (https://doi.org/10.3390/ma15062120) - 14 Mar 2022

Open Access Article (/1996-1944/15/6/2119/pdf?version=1647177143)

Effect of Annealing Temperature on the Interfacial Microstructure and Bonding Strength of Cu/Al Clad Sheets with a Stainless Steel Interlayer (/1996-1944/15/6/2119)

Materials **2022**, *15*(6), 2119; https://doi.org/10.3390/ma15062119 (https://doi.org/10.3390/ma15062119) - 13 Mar 2022

Open Access Article (/1996-1944/15/6/2118/pdf?version=1647179975)

The Influence of the Elemental Composition, Crystal Structure, and Grain Structure of the Ferro-Piezoceramics of Various Degrees of the Ferro-Hardness on the Stability of the Polarized State (/1996-1944/15/6/2118)

Materials **2022**, *15*(6), 2118; **https://doi.org/10.3390/ma15062118 (https://doi.org/10.3390/ma15062118)** - 13 Mar 2022

Open Access Article (/1996-1944/15/6/2117/pdf?version=1647174859)

Study on Radiation Shielding Properties of New Barium-Doped Zinc Tellurite Glass (/1996-1944/15/6/2117)

Materials **2022**, *15*(6), 2117; **https://doi.org/10.3390/ma15062117 (https://doi.org/10.3390/ma15062117)** - 13 Mar 2022

Open Access Article (/1996-1944/15/6/2116/pdf?version=1647171125)

Studies on Electron Escape Condition in Semiconductor Nanomaterials via Photodeposition Reaction (/1996-1944/15/6/2116)

Materials **2022**, *15*(6), 2116; **https://doi.org/10.3390/ma15062116 (https://doi.org/10.3390/ma15062116)** - 13 Mar 2022

Open Access Article (/1996-1944/15/6/2115/pdf?version=1647332051)

Research on the Induced Electrostatic Discharge of Spacecraft Typical Dielectric Materials under the ESD Pulse Irradiation (/1996-1944/15/6/2115)

Materials **2022**, *15*(6), 2115; **https://doi.org/10.3390/ma15062115 (https://doi.org/10.3390/ma15062115)** - 13 Mar 2022

Open Access Article (/1996-1944/15/6/2114/pdf?version=1647344382)

Sodium Alginate–Gelatin Nanoformulations for Encapsulation of *Bacillus velezensis* and Their Use for Biological Control of Pistachio Gummosis (/1996-1944/15/6/2114)

Materials **2022**, *15*(6), 2114; **https://doi.org/10.3390/ma15062114 (https://doi.org/10.3390/ma15062114)** - 13 Mar 2022

Open Access Article (/1996-1944/15/6/2113/pdf?version=1647175363)

Mechanical and Lubrication Properties of Double Network Ion Gels Obtained by a One-Step Process (/1996-1944/15/6/2113)

Materials **2022**, *15*(6), 2113; **https://doi.org/10.3390/ma15062113 (https://doi.org/10.3390/ma15062113)** - 13 Mar 2022

Open Access Article (/1996-1944/15/6/2112/pdf?version=1647252485)

Research on Performance of SBS-PPA and SBR-PPA Compound Modified Asphalts (/1996-1944/15/6/2112)

Materials **2022**, *15*(6), 2112; **https://doi.org/10.3390/ma15062112 (https://doi.org/10.3390/ma15062112)** - 13 Mar 2022

Open Access Review (/1996-1944/15/6/2111/pdf?version=1647162336)

Recent Advancements in the Fabrication of Functional Nanoporous Materials and Their Biomedical Applications (/1996-1944/15/6/2111)

Materials **2022**, *15*(6), 2111; **https://doi.org/10.3390/ma15062111 (https://doi.org/10.3390/ma15062111)** - 13 Mar 2022

Open Access Article (/1996-1944/15/6/2110/pdf?version=1647152432)

High-Energy Heavy Ion Irradiation of Al_2O_3, MgO and CaF_2 (/1996-1944/15/6/2110)

Materials **2022**, *15*(6), 2110; **https://doi.org/10.3390/ma15062110 (https://doi.org/10.3390/ma15062110)** - 13 Mar 2022

Open Access Article (/1996-1944/15/6/2109/pdf?version=1647152377)

Accelerated Curing for Glass-Based Mortars Using Water at 80 °C (/1996-1944/15/6/2109)

Materials **2022**, *15*(6), 2109; **https://doi.org/10.3390/ma15062109 (https://doi.org/10.3390/ma15062109)** - 13 Mar 2022

Open Access Article (/1996-1944/15/6/2108/pdf?version=1647498627)

A Frequency-Adjustable Tuning Fork Electromagnetic Energy Harvester (/1996-1944/15/6/2108)

Materials **2022**, *15*(6), 2108; **https://doi.org/10.3390/ma15062108 (https://doi.org/10.3390/ma15062108)** - 12 Mar 2022

Open Access Article (/1996-1944/15/6/2107/pdf?version=1648031861)

Numerical and Experimental Investigation of Quasi-Static Crushing Behaviors of Steel Tubular Structures (/1996-1944/15/6/2107)

Materials **2022**, *15*(6), 2107; **https://doi.org/10.3390/ma15062107 (https://doi.org/10.3390/ma15062107)** - 12 Mar 2022

Open Access Article (/1996-1944/15/6/2106/pdf?version=1647245875)

A Closer Look at Precision Hard Turning of AISI4340: Multi-Objective Optimization for Simultaneous Low Surface Roughness and High Productivity (/1996-1944/15/6/2106)

Materials **2022**, *15*(6), 2106; **https://doi.org/10.3390/ma15062106 (https://doi.org/10.3390/ma15062106)** - 12 Mar 2022

Open Access Article (/1996-1944/15/6/2105/pdf?version=1647400224)

Preparation and Characterization of Doxycycline-Loaded Electrospun PLA/HAP Nanofibers as a Drug Delivery System (/1996-1944/15/6/2105)

Materials **2022**, *15*(6), 2105; **https://doi.org/10.3390/ma15062105 (https://doi.org/10.3390/ma15062105)** - 12 Mar 2022

Open Access Article (/1996-1944/15/6/2104/pdf?version=1647076967)

The Cytocompatibility of Silver Diamine Fluoride on Mesenchymal Stromal Cells from Human Exfoliated Deciduous Teeth: An In Vitro Study (/1996-1944/15/6/2104)

Materials **2022**, *15*(6), 2104; **https://doi.org/10.3390/ma15062104 (https://doi.org/10.3390/ma15062104)** - 12 Mar 2022

Open Access Article **(/1996-1944/15/6/2103/pdf?version=1647074413)**

The Accuracy of Open-Tray vs. Snap on Impression Techniques in A 6-Implant Model: An In Vitro 3D Study (/1996-1944/15/6/2103)

Materials **2022**, *15*(6), 2103; **https://doi.org/10.3390/ma15062103 (https://doi.org/10.3390/ma15062103)** - 12 Mar 2022

Open Access Article **(/1996-1944/15/6/2102/pdf?version=1647514641)**

Influence of Thin Film Deposition on AFM Cantilever Tips in Adhesion and Young's Modulus of MEMS Surfaces (/1996-1944/15/6/2102)

Materials **2022**, *15*(6), 2102; **https://doi.org/10.3390/ma15062102 (https://doi.org/10.3390/ma15062102)** - 12 Mar 2022

Open Access Article **(/1996-1944/15/6/2101/pdf?version=1647073324)**

Effects of Aluminum Oxide Addition on Electrical and Mechanical Properties of 3 mol% Yttria-Stabilized Tetragonal Zirconia Electrolyte for IT-SOFCs (/1996-1944/15/6/2101)

Materials **2022**, *15*(6), 2101; **https://doi.org/10.3390/ma15062101 (https://doi.org/10.3390/ma15062101)** - 12 Mar 2022

Open Access Article **(/1996-1944/15/6/2100/pdf?version=1647835096)**

Reorientation of Suspended Ceramic Particles in Robocasted Green Filaments during Drying (/1996-1944/15/6/2100)

Materials **2022**, *15*(6), 2100; **https://doi.org/10.3390/ma15062100 (https://doi.org/10.3390/ma15062100)** - 12 Mar 2022

Open Access Editorial **(/1996-1944/15/6/2099/pdf?version=1647071066)**

SI: Advances in Density Functional Theory (DFT) Studies of Solids (/1996-1944/15/6/2099)

Materials **2022**, *15*(6), 2099; **https://doi.org/10.3390/ma15062099 (https://doi.org/10.3390/ma15062099)** - 12 Mar 2022

Open Access Editorial **(/1996-1944/15/6/2098/pdf?version=1647068318)**

Special Issue: Advances in Dental Bio-Nanomaterials (/1996-1944/15/6/2098)

Materials **2022**, *15*(6), 2098; **https://doi.org/10.3390/ma15062098 (https://doi.org/10.3390/ma15062098)** - 12 Mar 2022

Open Access Article **(/1996-1944/15/6/2097/pdf?version=1647062086)**

Temperature- and Frequency-Dependent Ferroelectric Characteristics of Metal-Ferroelectric-Metal Capacitors with Atomic-Layer-Deposited Undoped HfO_2 Films (/1996-1944/15/6/2097)

Materials **2022**, *15*(6), 2097; **https://doi.org/10.3390/ma15062097 (https://doi.org/10.3390/ma15062097)** - 12 Mar 2022

Open Access Article **(/1996-1944/15/6/2096/pdf?version=1647018905)**

Enhancing Thermoelectric Properties of $(Cu_2Te)_{1-x}$-$(BiCuTeO)_x$ Composites by Optimizing Carrier Concentration (/1996-1944/15/6/2096)

Materials **2022**, *15*(6), 2096; **https://doi.org/10.3390/ma15062096 (https://doi.org/10.3390/ma15062096)** - 11 Mar 2022

Open Access Article **(/1996-1944/15/6/2095/pdf?version=1649849420)**

Aminopropyltriethoxysilane (APTES)-Modified Nanohydroxyapatite (nHAp) Incorporated with Iron Oxide (IO) Nanoparticles Promotes Early Osteogenesis, Reduces Inflammation and Inhibits Osteoclast Activity (/1996-1944/15/6/2095)

Materials **2022**, *15*(6), 2095; **https://doi.org/10.3390/ma15062095 (https://doi.org/10.3390/ma15062095)** - 11 Mar 2022

Open Access Article **(/1996-1944/15/6/2094/pdf?version=1647349415)**

Influence of Nanofibrillated Bacterial Cellulose on the Properties of Ordinary and Expansive Mortars (/1996-1944/15/6/2094)

Materials **2022**, *15*(6), 2094; **https://doi.org/10.3390/ma15062094 (https://doi.org/10.3390/ma15062094)** - 11 Mar 2022

Open Access Article **(/1996-1944/15/6/2093/pdf?version=1647010979)**

Microstructure and Hardness of Hollow Tube Shells at Piercing in Two-High Screw Rolling Mill with Different Plugs (/1996-1944/15/6/2093)

Materials **2022**, *15*(6), 2093; **https://doi.org/10.3390/ma15062093 (https://doi.org/10.3390/ma15062093)** - 11 Mar 2022

Open Access Article **(/1996-1944/15/6/2092/pdf?version=1647009784)**

Combination of Pre- and Post-Mercerization Processes for Cotton Fabric (/1996-1944/15/6/2092)

Materials **2022**, *15*(6), 2092; **https://doi.org/10.3390/ma15062092 (https://doi.org/10.3390/ma15062092)** - 11 Mar 2022

Open Access Article **(/1996-1944/15/6/2091/pdf?version=1648116693)**

Influence of 3D Printing Parameters on the Mechanical Stability of PCL Scaffolds and the Proliferation Behavior of Bone Cells (/1996-1944/15/6/2091)

Materials **2022**, *15*(6), 2091; **https://doi.org/10.3390/ma15062091 (https://doi.org/10.3390/ma15062091)** - 11 Mar 2022

Open Access Article **(/1996-1944/15/6/2090/pdf?version=1647505204)**

Electrical Properties of Aluminum Nitride Thick Films Magnetron Sputtered on Aluminum Substrates (/1996-1944/15/6/2090)

Materials **2022**, *15*(6), 2090; **https://doi.org/10.3390/ma15062090 (https://doi.org/10.3390/ma15062090)** - 11 Mar 2022

Open Access Article (/1996-1944/15/6/2089/pdf?version=1647314014)

MDPI (/)

Recovery of Non-Ferrous Metals from PCBs Scrap by Liquation from Lead (/1996-1944/15/6/2089)

Materials **2022**, *15*(6), 2089; **https://doi.org/10.3390/ma15062089 (https://doi.org/10.3390/ma15062089)** - 11 Mar 2022 (/toggle_desktop_layout_cookie)

Open Access Systematic Review (/1996-1944/15/6/2088/pdf?version=1647227128)

The Adjunctive Use of Leucocyte- and Platelet-Rich Fibrin in Periodontal Endosseous and Furcation Defects: A Systematic Review and Meta-Analysis (/1996-1944/15/6/2088)

Materials **2022**, *15*(6), 2088; **https://doi.org/10.3390/ma15062088 (https://doi.org/10.3390/ma15062088)** - 11 Mar 2022

Open Access Article (/1996-1944/15/6/2087/pdf?version=1647001421)

Elimination of Composition Segregation in 33Al–45Cu–22Fe (at.%) Powder by Two-Stage High-Energy Mechanical Alloying (/1996-1944/15/6/2087)

Materials **2022**, *15*(6), 2087; **https://doi.org/10.3390/ma15062087 (https://doi.org/10.3390/ma15062087)** - 11 Mar 2022

Open Access Review (/1996-1944/15/6/2086/pdf?version=1647007322)

Insights into Nanomedicine for Head and Neck Cancer Diagnosis and Treatment (/1996-1944/15/6/2086)

Materials **2022**, *15*(6), 2086; **https://doi.org/10.3390/ma15062086 (https://doi.org/10.3390/ma15062086)** - 11 Mar 2022

Open Access Article (/1996-1944/15/6/2085/pdf?version=1647003513)

Memristive FG–PVA Structures Fabricated with the Use of High Energy Xe Ion Irradiation (/1996-1944/15/6/2085)

Materials **2022**, *15*(6), 2085; **https://doi.org/10.3390/ma15062085 (https://doi.org/10.3390/ma15062085)** - 11 Mar 2022

Open Access Editor's Choice Review (/1996-1944/15/6/2084/pdf?version=1647230090)

Achievements and Future Perspectives of the Trivalent Thulium-Ion-Doped Mixed-Sesquioxide Ceramics for Laser Applications (/1996-1944/15/6/2084)

Materials **2022**, *15*(6), 2084; **https://doi.org/10.3390/ma15062084 (https://doi.org/10.3390/ma15062084)** - 11 Mar 2022

Open Access Article (/1996-1944/15/6/2083/pdf?version=1647052790)

Influence of Doping on the Topological Surface States of Crystalline Bi_2Se_3 Topological Insulators (/1996-1944/15/6/2083)

Materials **2022**, *15*(6), 2083; **https://doi.org/10.3390/ma15062083 (https://doi.org/10.3390/ma15062083)** - 11 Mar 2022

Open Access Article (/1996-1944/15/6/2082/pdf?version=1646998472)

Tribological Characteristics of a-C:H:Si and a-C:H:SiO_x Coatings Tested in Simulated Body Fluid and Protein Environment (/1996-1944/15/6/2082)

Materials **2022**, *15*(6), 2082; **https://doi.org/10.3390/ma15062082 (https://doi.org/10.3390/ma15062082)** - 11 Mar 2022

Open Access Review (/1996-1944/15/6/2081/pdf?version=1646999922)

Review on Preformed Crowns in Pediatric Dentistry—The Composition and Application (/1996-1944/15/6/2081)

Materials **2022**, *15*(6), 2081; **https://doi.org/10.3390/ma15062081 (https://doi.org/10.3390/ma15062081)** - 11 Mar 2022

Open Access Article (/1996-1944/15/6/2080/pdf?version=1646992561)

Synergistic Effect of Sic Particles and Whiskers on the Microstructures and Mechanical Properties of Ti(C,N)-Based Cermets (/1996-1944/15/6/2080)

Materials **2022**, *15*(6), 2080; **https://doi.org/10.3390/ma15062080 (https://doi.org/10.3390/ma15062080)** - 11 Mar 2022

Open Access Article (/1996-1944/15/6/2079/pdf?version=1647008515)

Effect of the $Ca_2Mg_6Zn_3$ Phase on the Corrosion Behavior of Biodegradable Mg-4.0Zn-0.2Mn-*x*Ca Alloys in Hank's Solution (/1996-1944/15/6/2079)

Materials **2022**, *15*(6), 2079; **https://doi.org/10.3390/ma15062079 (https://doi.org/10.3390/ma15062079)** - 11 Mar 2022

Open Access Article (/1996-1944/15/6/2078/pdf?version=1647426848)

Fabricated Flexible Composite for a UV-LED Color Filter and Anti-Counterfeiting Application of Calcium Molybdate Phosphor Synthesized at Room Temperature (/1996-1944/15/6/2078)

Materials **2022**, *15*(6), 2078; **https://doi.org/10.3390/ma15062078 (https://doi.org/10.3390/ma15062078)** - 11 Mar 2022

Open Access Article (/1996-1944/15/6/2077/pdf?version=1647227747)

An Inverse Analysis for Establishing the Temperature-Dependent Thermal Conductivity of a Melt-Cast Explosive across the Whole Solidification Process (/1996-1944/15/6/2077)

Materials **2022**, *15*(6), 2077; **https://doi.org/10.3390/ma15062077 (https://doi.org/10.3390/ma15062077)** - 11 Mar 2022

Open Access Article (/1996-1944/15/6/2076/pdf?version=1646989336)

[Control of Polarization Orientation Angle of Scattered Light Based on Metasurfaces: −90° to +90° Linear Variation (/1996-1944/15/6/2076)]

Materials **2022**, *15*(6), 2076; **https://doi.org/10.3390/ma15062076 (https://doi.org/10.3390/ma15062076)** - 11 Mar 2022

Open Access Article (/1996-1944/15/6/2075/pdf?version=1646994733)

Research on Meshing Gears CIMT Design and Anti-Thermoelastic Scuffing Load-Bearing Characteristics (/1996-1944/15/6/2075)

Materials **2022**, *15*(6), 2075; **https://doi.org/10.3390/ma15062075 (https://doi.org/10.3390/ma15062075)** - 11 Mar 2022

Open Access Article (/1996-1944/15/6/2074/pdf?version=1646992864)

Third-Generation Thermodynamic Descriptions for Ta-Cr and Ta-V Binary Systems (/1996-1944/15/6/2074)

Materials **2022**, *15*(6), 2074; **https://doi.org/10.3390/ma15062074 (https://doi.org/10.3390/ma15062074)** - 11 Mar 2022

Open Access Article (/1996-1944/15/6/2073/pdf?version=1646995783)

Computational and Experimental Study of Nonlinear Optical Susceptibilities of Composite Materials Based on PVK Polymer Matrix and Benzonitrile Derivatives (/1996-1944/15/6/2073)

Materials **2022**, *15*(6), 2073; **https://doi.org/10.3390/ma15062073 (https://doi.org/10.3390/ma15062073)** - 11 Mar 2022

Open Access Article (/1996-1944/15/6/2072/pdf?version=1646985814)

Enhanced Magnetostrain in a <0 0 1>$_A$-Textured $Ni_{44.5}Co_{4.9}Mn_{37.5}In_{13.1}$ Alloy through Superelastic Training (/1996-1944/15/6/2072)

Materials **2022**, *15*(6), 2072; **https://doi.org/10.3390/ma15062072 (https://doi.org/10.3390/ma15062072)** - 11 Mar 2022

Open Access Article (/1996-1944/15/6/2071/pdf?version=1647481474)

Surface Evaluation of Orthodontic Brackets Using Texture and Fractal Dimension Analysis (/1996-1944/15/6/2071)

Materials **2022**, *15*(6), 2071; **https://doi.org/10.3390/ma15062071 (https://doi.org/10.3390/ma15062071)** - 11 Mar 2022

Open Access Article (/1996-1944/15/6/2070/pdf?version=1646983154)

Effects of Natural Brown Cotton Bleached Gauze on Wound Healing (/1996-1944/15/6/2070)

Materials **2022**, *15*(6), 2070; **https://doi.org/10.3390/ma15062070 (https://doi.org/10.3390/ma15062070)** - 11 Mar 2022

Open Access Article (/1996-1944/15/6/2069/pdf?version=1646983207)

Characterization of Bioactive Colored Materials Produced from Bacterial Cellulose and Bacterial Pigments (/1996-1944/15/6/2069)

Materials **2022**, *15*(6), 2069; **https://doi.org/10.3390/ma15062069 (https://doi.org/10.3390/ma15062069)** - 11 Mar 2022

Open Access Article (/1996-1944/15/6/2068/pdf?version=1646984051)

Attachment of Chiral Functional Groups to Modify the Activity of New GPx Mimetics (/1996-1944/15/6/2068)

Materials **2022**, *15*(6), 2068; **https://doi.org/10.3390/ma15062068 (https://doi.org/10.3390/ma15062068)** - 11 Mar 2022

Open Access Article (/1996-1944/15/6/2067/pdf?version=1646983384)

Rehydration Driven Acid Impregnation of Thermally Pretreated Ca-Bentonite—Evolution of the Clay Structure (/1996-1944/15/6/2067)

Materials **2022**, *15*(6), 2067; **https://doi.org/10.3390/ma15062067 (https://doi.org/10.3390/ma15062067)** - 11 Mar 2022

Open Access Editor’s Choice Article (/1996-1944/15/6/2066/pdf?version=1646982504)

High-Frequency and High-Power Performance of *n*-Type GaN Epilayers with Low Electron Density Grown on Native Substrate (/1996-1944/15/6/2066)

Materials **2022**, *15*(6), 2066; **https://doi.org/10.3390/ma15062066 (https://doi.org/10.3390/ma15062066)** - 11 Mar 2022

Open Access Article (/1996-1944/15/6/2065/pdf?version=1646991220)

Effect of Holding Time on Densification, Microstructure and Selected Properties of Spark Plasma Sintered AA7075-B_4C Composites (/1996-1944/15/6/2065)

Materials **2022**, *15*(6), 2065; **https://doi.org/10.3390/ma15062065 (https://doi.org/10.3390/ma15062065)** - 11 Mar 2022

Open Access Article (/1996-1944/15/6/2064/pdf?version=1646968616)

Finite Element Analysis of the Ballistic Impact on Auxetic Sandwich Composite Human Body Armor (/1996-1944/15/6/2064)

Materials **2022**, *15*(6), 2064; **https://doi.org/10.3390/ma15062064 (https://doi.org/10.3390/ma15062064)** - 11 Mar 2022

Open Access Article (/1996-1944/15/6/2063/pdf?version=1646965174)

Development and Verification Experiment of In-Situ Friction Experiment Device for Simulating UV Irradiation in Space (/1996-1944/15/6/2063)

Materials **2022**, *15*(6), 2063; **https://doi.org/10.3390/ma15062063 (https://doi.org/10.3390/ma15062063)** - 11 Mar 2022

Open Access Article (/1996-1944/15/6/2062/pdf?version=1646961458)

Open Access Review [(/1996-1944/15/6/2047/pdf?version=1648035526)]

MDPI (/)

Additive Manufacturing of AlSi10Mg and Ti6Al4V Lightweight Alloys via Laser Powder Bed Fusion: A Review of Heat Treatments Effects (/1996-1944/15/6/2047)

(/toggle_desktop_layout_cookie)

Materials **2022**, *15*(6), 2047; **https://doi.org/10.3390/ma15062047 (https://doi.org/10.3390/ma15062047)** - 10 Mar 2022

Open Access Article (/1996-1944/15/6/2046/pdf?version=1646913346)

Environmental Impact of Surgical Masks Consumption in Italy Due to COVID-19 Pandemic (/1996-1944/15/6/2046)

Materials **2022**, *15*(6), 2046; **https://doi.org/10.3390/ma15062046 (https://doi.org/10.3390/ma15062046)** - 10 Mar 2022

Open Access Article (/1996-1944/15/6/2045/pdf?version=1646965858)

Increasing Acid Concentration, Time and Using a Two-Part Silane Potentiates Bond Strength of Lithium Disilicate–Reinforced Glass Ceramic to Resin Composite: An Exploratory Laboratory Study (/1996-1944/15/6/2045)

Materials **2022**, *15*(6), 2045; **https://doi.org/10.3390/ma15062045 (https://doi.org/10.3390/ma15062045)** - 10 Mar 2022

Open Access Article (/1996-1944/15/6/2044/pdf?version=1647424057)

Wide Concentration Range of Tb^{3+} Doping Influence on Scintillation Properties of $(Ce, Tb, Gd)_3Ga_2Al_3O_{12}$ Crystals Grown by the Optical Floating Zone Method (/1996-1944/15/6/2044)

Materials **2022**, *15*(6), 2044; **https://doi.org/10.3390/ma15062044 (https://doi.org/10.3390/ma15062044)** - 10 Mar 2022

Open Access Article (/1996-1944/15/6/2043/pdf?version=1646909248)

Composites Containing Nanohydroxyapatites and a Stable TEMPO Radical: Preparation and Characterization Using Spectrophotometry, EPR and ^{1}H MAS NMR (/1996-1944/15/6/2043)

Materials **2022**, *15*(6), 2043; **https://doi.org/10.3390/ma15062043 (https://doi.org/10.3390/ma15062043)** - 10 Mar 2022

Open Access Article (/1996-1944/15/6/2042/pdf?version=1646909428)

Development of 2.45 GHz Semiconductor Microwave System for Combustion Ignition Enhancement and Failure Analysis (/1996-1944/15/6/2042)

Materials **2022**, *15*(6), 2042; **https://doi.org/10.3390/ma15062042 (https://doi.org/10.3390/ma15062042)** - 10 Mar 2022

Open Access Article (/1996-1944/15/6/2041/pdf?version=1646908139)

Relationship of Mineralogical Composition to Thermal Expansion, Spectral Reflectance, and Physico-Mechanical Aspects of Commercial Ornamental Granitic Rocks (/1996-1944/15/6/2041)

Materials **2022**, *15*(6), 2041; **https://doi.org/10.3390/ma15062041 (https://doi.org/10.3390/ma15062041)** - 10 Mar 2022

Open Access Article (/1996-1944/15/6/2040/pdf?version=1646907201)

Experimental Verification of Thermal Insulation in Timber Framed Walls (/1996-1944/15/6/2040)

Materials **2022**, *15*(6), 2040; **https://doi.org/10.3390/ma15062040 (https://doi.org/10.3390/ma15062040)** - 10 Mar 2022

Open Access Article (/1996-1944/15/6/2039/pdf?version=1646907184)

Fe_3O_4@PDA@PEI Core-Shell Microspheres as a Novel Magnetic Sorbent for the Rapid and Broad-Spectrum Separation of Bacteria in Liquid Phase (/1996-1944/15/6/2039)

Materials **2022**, *15*(6), 2039; **https://doi.org/10.3390/ma15062039 (https://doi.org/10.3390/ma15062039)** - 10 Mar 2022

Open Access Article (/1996-1944/15/6/2038/pdf?version=1646912246)

Grain Refinement of Inconel 718 Superalloy—The Effect of Rotating Magnetic Field (/1996-1944/15/6/2038)

Materials **2022**, *15*(6), 2038; **https://doi.org/10.3390/ma15062038 (https://doi.org/10.3390/ma15062038)** - 10 Mar 2022

Open Access Article (/1996-1944/15/6/2037/pdf?version=1647922831)

Multi-Steps Magnetic Flux Entrance/Exit at Thermomagnetic Avalanches in the Plates of Hard Superconductors (/1996-1944/15/6/2037)

Materials **2022**, *15*(6), 2037; **https://doi.org/10.3390/ma15062037 (https://doi.org/10.3390/ma15062037)** - 10 Mar 2022

Open Access Article (/1996-1944/15/6/2036/pdf?version=1646901609)

Effect of Sulfate Concentration on Chloride Diffusion of Concrete under Cyclic Load (/1996-1944/15/6/2036)

Materials **2022**, *15*(6), 2036; **https://doi.org/10.3390/ma15062036 (https://doi.org/10.3390/ma15062036)** - 10 Mar 2022

Open Access Article (/1996-1944/15/6/2035/pdf?version=1646905675)

Investigating the Mechanical Properties and Durability of Metakaolin-Incorporated Mortar by Different Curing Methods (/1996-1944/15/6/2035)

Materials **2022**, *15*(6), 2035; **https://doi.org/10.3390/ma15062035 (https://doi.org/10.3390/ma15062035)** - 10 Mar 2022

Open Access Article (/1996-1944/15/6/2034/pdf?version=1646900193)

Boron Oxide Enhancing Stability of MoS_2 Anode Materials for Lithium-Ion Batteries (/1996-1944/15/6/2034)
Materials **2022**, *15*(6), 2034; **https://doi.org/10.3390/ma15062034 (https://doi.org/10.3390/ma15062034)** - 10 Mar 2022

Open Access Article (/1996-1944/15/6/2033/pdf?version=1647923707)

Research on Dynamic Performance of CRTSIII Type Slab Ballastless Track under Long-Term Service (/1996-1944/15/6/2033)
Materials **2022**, *15*(6), 2033; **https://doi.org/10.3390/ma15062033 (https://doi.org/10.3390/ma15062033)** - 10 Mar 2022

Open Access Article (/1996-1944/15/6/2032/pdf?version=1646988176)

Exploratory Data Analysis for the Evaluation of Tribological Properties of Wear-Resistant Surface Layers Modified with Rare-Earth Metals (/1996-1944/15/6/2032)
Materials **2022**, *15*(6), 2032; **https://doi.org/10.3390/ma15062032 (https://doi.org/10.3390/ma15062032)** - 09 Mar 2022

Open Access Article (/1996-1944/15/6/2031/pdf?version=1648017894)

Tool Wear Effect on Surface Integrity in AISI 1045 Steel Dry Turning (/1996-1944/15/6/2031)
Materials **2022**, *15*(6), 2031; **https://doi.org/10.3390/ma15062031 (https://doi.org/10.3390/ma15062031)** - 09 Mar 2022

Open Access Editor's Choice Review (/1996-1944/15/6/2030/pdf?version=1646891918)

Production and Upgrading of Recovered Carbon Black from the Pyrolysis of End-of-Life Tires (/1996-1944/15/6/2030)
Materials **2022**, *15*(6), 2030; **https://doi.org/10.3390/ma15062030 (https://doi.org/10.3390/ma15062030)** - 09 Mar 2022

Open Access Article (/1996-1944/15/6/2029/pdf?version=1646884477)

Experimental Investigation on the Breaching Process of Landslide Dams with Differing Materials under Different Inflow Conditions (/1996-1944/15/6/2029)
Materials **2022**, *15*(6), 2029; **https://doi.org/10.3390/ma15062029 (https://doi.org/10.3390/ma15062029)** - 09 Mar 2022

Open Access Article (/1996-1944/15/6/2028/pdf?version=1646830393)

Enhanced Corrosion Resistance of Layered Double Hydroxide Films on Mg Alloy: The Key Role of Cationic Surfactant (/1996-1944/15/6/2028)
Materials **2022**, *15*(6), 2028; **https://doi.org/10.3390/ma15062028 (https://doi.org/10.3390/ma15062028)** - 09 Mar 2022

Open Access Article (/1996-1944/15/6/2027/pdf?version=1646883610)

Vibration Excitation and Suppression of a Composite Laminate Plate Using Piezoelectric Actuators (/1996-1944/15/6/2027)
Materials **2022**, *15*(6), 2027; **https://doi.org/10.3390/ma15062027 (https://doi.org/10.3390/ma15062027)** - 09 Mar 2022

Open Access Editor's Choice Review (/1996-1944/15/6/2026/pdf?version=1646961965)

Current Research and Challenges in Bitumen Emulsion Manufacturing and Its Properties (/1996-1944/15/6/2026)
Materials **2022**, *15*(6), 2026; **https://doi.org/10.3390/ma15062026 (https://doi.org/10.3390/ma15062026)** - 09 Mar 2022

Open Access Article (/1996-1944/15/6/2025/pdf?version=1646824765)

Corrosion Behavior of an Mg_2Sn Alloy (/1996-1944/15/6/2025)
Materials **2022**, *15*(6), 2025; **https://doi.org/10.3390/ma15062025 (https://doi.org/10.3390/ma15062025)** - 09 Mar 2022

Open Access Article (/1996-1944/15/6/2024/pdf?version=1646824285)

Development of Rubber Packing Element for 105 MPa/215 °C Deep-Well Test Packer (/1996-1944/15/6/2024)
Materials **2022**, *15*(6), 2024; **https://doi.org/10.3390/ma15062024 (https://doi.org/10.3390/ma15062024)** - 09 Mar 2022

Open Access Review (/1996-1944/15/6/2023/pdf?version=1647521505)

Organic Compounds as Corrosion Inhibitors for Carbon Steel in HCl Solution: A Comprehensive Review (/1996-1944/15/6/2023)
Materials **2022**, *15*(6), 2023; **https://doi.org/10.3390/ma15062023 (https://doi.org/10.3390/ma15062023)** - 09 Mar 2022

Open Access Article (/1996-1944/15/6/2022/pdf?version=1646843315)

Influence of Elevated Temperatures and Cooling Method on the Microstructure Development and Phase Evolution of Alkali-Activated Slag (/1996-1944/15/6/2022)
Materials **2022**, *15*(6), 2022; **https://doi.org/10.3390/ma15062022 (https://doi.org/10.3390/ma15062022)** - 09 Mar 2022

Open Access Article (/1996-1944/15/6/2021/pdf?version=1646821724)

Sol-Gel Synthesis and Characterization of the Cu-Mg-O System for Chemical Looping Application (/1996-1944/15/6/2021)
Materials **2022**, *15*(6), 2021; **https://doi.org/10.3390/ma15062021 (https://doi.org/10.3390/ma15062021)** - 09 Mar 2022

Open Access Article (/1996-1944/15/6/2020/pdf?version=1646834945)

Structural and Mechanical Changes of $AlMgSi_{0.5}$ Alloy during Extrusion by ECAP Method (/1996-1944/15/6/2020)

Materials **2022**, *15*(6), 2020; **https://doi.org/10.3390/ma15062020 (https://doi.org/10.3390/ma15062020)** - 09 Mar 2022

Open Access Article **(/1996-1944/15/6/2019/pdf?version=1646818590)**

Controllable Preparation of Spherical Molybdenum Nano-Powders by One-Step Reduction of APM in Radio Frequency Hydrogen Plasma (/1996-1944/15/6/2019)

Materials **2022**, *15*(6), 2019; **https://doi.org/10.3390/ma15062019 (https://doi.org/10.3390/ma15062019)** - 09 Mar 2022

Open Access Article **(/1996-1944/15/6/2018/pdf?version=1646817760)**

Multi-Response Optimization of Al_2O_3 Nanopowder-Mixed Wire Electrical Discharge Machining Process Parameters of Nitinol Shape Memory Alloy (/1996-1944/15/6/2018)

Materials **2022**, *15*(6), 2018; **https://doi.org/10.3390/ma15062018 (https://doi.org/10.3390/ma15062018)** - 09 Mar 2022

Open Access Article **(/1996-1944/15/6/2017/pdf?version=1646815549)**

The Influence of the Deformation Method on the Microstructure and Properties of Magnesium Alloy Mg-Y-RE-Zr (/1996-1944/15/6/2017)

Materials **2022**, *15*(6), 2017; **https://doi.org/10.3390/ma15062017 (https://doi.org/10.3390/ma15062017)** - 09 Mar 2022

Open Access Editorial **(/1996-1944/15/6/2016/pdf?version=1646820571)**

Bioactive Dental Materials: The Current Status (/1996-1944/15/6/2016)

Materials **2022**, *15*(6), 2016; **https://doi.org/10.3390/ma15062016 (https://doi.org/10.3390/ma15062016)** - 09 Mar 2022

Open Access Article **(/1996-1944/15/6/2015/pdf?version=1646812147)**

Assessing the Mechanical Properties of a New High Strength Aluminum Hybrid MMC Based on the ANN Approach for Automotive Application (/1996-1944/15/6/2015)

Materials **2022**, *15*(6), 2015; **https://doi.org/10.3390/ma15062015 (https://doi.org/10.3390/ma15062015)** - 09 Mar 2022

Open Access Article **(/1996-1944/15/6/2014/pdf?version=1646878125)**

Accelerated Endothelialization of Nanofibrous Scaffolds for Biomimetic Cardiovascular Implants (/1996-1944/15/6/2014)

Materials **2022**, *15*(6), 2014; **https://doi.org/10.3390/ma15062014 (https://doi.org/10.3390/ma15062014)** - 09 Mar 2022

Open Access Article **(/1996-1944/15/6/2013/pdf?version=1646802647)**

Influence of Asymmetric Rolling Process on the Microstructure Properties of Bimetallic Sheet Metals (/1996-1944/15/6/2013)

Materials **2022**, *15*(6), 2013; **https://doi.org/10.3390/ma15062013 (https://doi.org/10.3390/ma15062013)** - 09 Mar 2022

Open Access Article **(/1996-1944/15/6/2012/pdf?version=1646754541)**

***In Vitro* Evaluation of the Antibacterial Activity of EndoSeal MTA, iRoot SP, and AH Plus against Planktonic Bacteria (/1996-1944/15/6/2012)**

Materials **2022**, *15*(6), 2012; **https://doi.org/10.3390/ma15062012 (https://doi.org/10.3390/ma15062012)** - 08 Mar 2022

Open Access Article **(/1996-1944/15/6/2011/pdf?version=1646798059)**

Rational Design of Waterborne Polyurethane Pressure Sensitive Adhesives for Different Working Temperatures (/1996-1944/15/6/2011)

Materials **2022**, *15*(6), 2011; **https://doi.org/10.3390/ma15062011 (https://doi.org/10.3390/ma15062011)** - 08 Mar 2022

Open Access Article **(/1996-1944/15/6/2010/pdf?version=1646908312)**

Effect of Admixtures on Durability and Physical-Mechanical Properties of Alkali-Activated Materials (/1996-1944/15/6/2010)

Materials **2022**, *15*(6), 2010; **https://doi.org/10.3390/ma15062010 (https://doi.org/10.3390/ma15062010)** - 08 Mar 2022

Open Access Editor’s Choice Article **(/1996-1944/15/6/2009/pdf?version=1646817120)**

Antimicrobial TiN-Ag Coatings in Leather Insole for Diabetic Foot (/1996-1944/15/6/2009)

Materials **2022**, *15*(6), 2009; **https://doi.org/10.3390/ma15062009 (https://doi.org/10.3390/ma15062009)** - 08 Mar 2022

Open Access Article **(/1996-1944/15/6/2008/pdf?version=1646830586)**

Integrating a Top-Gas Recycling and CO_2 Electrolysis Process for H_2-Rich Gas Injection and Reduce CO_2 Emissions from an Ironmaking Blast Furnace (/1996-1944/15/6/2008)

Materials **2022**, *15*(6), 2008; **https://doi.org/10.3390/ma15062008 (https://doi.org/10.3390/ma15062008)** - 08 Mar 2022

Open Access Editor’s Choice Article **(/1996-1944/15/6/2007/pdf?version=1646795030)**

Acoustic Characteristics of Microcellular Foamed Ceramic Urethane (/1996-1944/15/6/2007)

Materials **2022**, *15*(6), 2007; **https://doi.org/10.3390/ma15062007 (https://doi.org/10.3390/ma15062007)** - 08 Mar 2022

Open Access Article **(/1996-1944/15/6/2006/pdf?version=1646811085)**

Cross-Link Density, Mechanical and Thermal Properties of Chloroprene Rubber Cross-Linked with Silver(I) Oxide (/1996-1944/15/6/2006)

Materials **2022**, *15*(6), 2006; **https://doi.org/10.3390/ma15062006 (https://doi.org/10.3390/ma15062006)** - 08 Mar 2022

Open Access Article (/1996-1944/15/6/2005/pdf?version=1647425988)

A Comparative Study of Aluminium and Titanium Warm Sprayed Coatings on AZ91E Magnesium Alloy (/1996-1944/15/6/2005)

Materials **2022**, *15*(6), 2005; https://doi.org/10.3390/ma15062005 (https://doi.org/10.3390/ma15062005) - 08 Mar 2022

Open Access Article (/1996-1944/15/6/2004/pdf?version=1647221669)

^{13}C, ^{27}Al and ^{29}Si NMR Investigation of the Hydration Kinetics of Portland-Limestone Cement Pastes Containing CH_3-COO^--R^+ (R=H or Na) Additives (/1996-1944/15/6/2004)

Materials **2022**, *15*(6), 2004; https://doi.org/10.3390/ma15062004 (https://doi.org/10.3390/ma15062004) - 08 Mar 2022

Open Access Article (/1996-1944/15/6/2003/pdf?version=1646743676)

Plasma Electrolytic Oxidation of Zr-1%Nb Alloy: Effect of Sodium Silicate and Boric Acid Addition to Calcium Acetate-Based Electrolyte (/1996-1944/15/6/2003)

Materials **2022**, *15*(6), 2003; https://doi.org/10.3390/ma15062003 (https://doi.org/10.3390/ma15062003) - 08 Mar 2022

Open Access Article (/1996-1944/15/6/2002/pdf?version=1646833276)

Numerical Tensile Damage Procedure Analysis of Angle-Ply Laminate Using Multi-Scale RVEs with Smear Crack Models (/1996-1944/15/6/2002)

Materials **2022**, *15*(6), 2002; https://doi.org/10.3390/ma15062002 (https://doi.org/10.3390/ma15062002) - 08 Mar 2022

Open Access Article (/1996-1944/15/6/2001/pdf?version=1646813615)

Surface Analysis of Fermented Wheat and Rice Starch Used for Coating Traditional Korean Textiles (/1996-1944/15/6/2001)

Materials **2022**, *15*(6), 2001; https://doi.org/10.3390/ma15062001 (https://doi.org/10.3390/ma15062001) - 08 Mar 2022

Open Access Article (/1996-1944/15/6/2000/pdf?version=1647426061)

Precise Modeling of Thermal and Strain Rate Effect on the Hardening Behavior of SiC/Al Composite (/1996-1944/15/6/2000)

Materials **2022**, *15*(6), 2000; https://doi.org/10.3390/ma15062000 (https://doi.org/10.3390/ma15062000) - 08 Mar 2022

Open Access Article (/1996-1944/15/6/1999/pdf?version=1646902275)

Cooling Effect of Phase Change Materials Applied in Undergarments of Mine Rescuers in Simulated Utility Conditions on Thermal Manikin (/1996-1944/15/6/1999)

Materials **2022**, *15*(6), 1999; https://doi.org/10.3390/ma15061999 (https://doi.org/10.3390/ma15061999) - 08 Mar 2022

Open Access Article (/1996-1944/15/6/1998/pdf?version=1646807057)

Impact of Fabric Construction on Adsorption and Spreading of Liquid Contaminations (/1996-1944/15/6/1998)

Materials **2022**, *15*(6), 1998; https://doi.org/10.3390/ma15061998 (https://doi.org/10.3390/ma15061998) - 08 Mar 2022

Open Access Article (/1996-1944/15/6/1997/pdf?version=1646736809)

Concrete by Preplaced Aggregate Method Using Silica Fume and Polypropylene Fibres (/1996-1944/15/6/1997)

Materials **2022**, *15*(6), 1997; https://doi.org/10.3390/ma15061997 (https://doi.org/10.3390/ma15061997) - 08 Mar 2022

Open Access Article (/1996-1944/15/6/1996/pdf?version=1646757541)

Modeling of Polycrystalline Material Microstructure with 3D Grain Boundary Based on Laguerre–Voronoi Tessellation (/1996-1944/15/6/1996)

Materials **2022**, *15*(6), 1996; https://doi.org/10.3390/ma15061996 (https://doi.org/10.3390/ma15061996) - 08 Mar 2022

Open Access Article (/1996-1944/15/6/1995/pdf?version=1646734606)

Wear Analysis of Additively Manufactured Slipper-Retainer in the Axial Piston Pump (/1996-1944/15/6/1995)

Materials **2022**, *15*(6), 1995; https://doi.org/10.3390/ma15061995 (https://doi.org/10.3390/ma15061995) - 08 Mar 2022

Open Access Article (/1996-1944/15/6/1994/pdf?version=1646733786)

Ion Release and Surface Changes of Nickel–Titanium Archwires Induced by Changes in the pH Value of the Saliva—Significance for Human Health Risk Assessment (/1996-1944/15/6/1994)

Materials **2022**, *15*(6), 1994; https://doi.org/10.3390/ma15061994 (https://doi.org/10.3390/ma15061994) - 08 Mar 2022

Open Access Article (/1996-1944/15/6/1993/pdf?version=1646731621)

Effect of Phase Composition on Leaching Behavior and Mechanical Properties of Ceramics from Ferrochrome Slag and Tundish Slag (/1996-1944/15/6/1993)

Materials **2022**, *15*(6), 1993; https://doi.org/10.3390/ma15061993 (https://doi.org/10.3390/ma15061993) - 08 Mar 2022

Open Access Article (/1996-1944/15/6/1992/pdf?version=1646730527)

Study of Influence of Atmospheric Conditions on the Thermal Properties of Sleeping Bags (/1996-1944/15/6/1992)

Materials **2022**, *15*(6), 1992; **https://doi.org/10.390/ma15061992 (https://doi.org/10.3390/ma15061992)** - 08 Mar 2022

MDPI (/)

Open Access Article **(/1996-1944/15/6/1991/pdf?version=1646731455)**

(/toggle_desktop_layout_cookie)

Testing Passenger Car Brake Pad Exploitation Time's Impact on the Values of the Coefficient of Friction and Abrasive Wear Rate Using a Pin-on-Disc Method (/1996-1944/15/6/1991)

Materials **2022**, *15*(6), 1991; **https://doi.org/10.3390/ma15061991 (https://doi.org/10.3390/ma15061991)** - 08 Mar 2022

Open Access Article **(/1996-1944/15/6/1990/pdf?version=1646881350)**

Surface Modification of Ammonium Polyphosphate for Enhancing Flame-Retardant Properties of Thermoplastic Polyurethane (/1996-1944/15/6/1990)

Materials **2022**, *15*(6), 1990; **https://doi.org/10.3390/ma15061990 (https://doi.org/10.3390/ma15061990)** - 08 Mar 2022

Open Access Article **(/1996-1944/15/6/1989/pdf?version=1646726373)**

Reliability Analysis of Critical Systems in A Fuel Booster Pump Using Advanced Simulation Techniques (/1996-1944/15/6/1989)

Materials **2022**, *15*(6), 1989; **https://doi.org/10.3390/ma15061989 (https://doi.org/10.3390/ma15061989)** - 08 Mar 2022

Open Access Review **(/1996-1944/15/6/1988/pdf?version=1646725826)**

The Use of Laser Energy for Etching Enamel Surfaces in Dentistry—A Scoping Review (/1996-1944/15/6/1988)

Materials **2022**, *15*(6), 1988; **https://doi.org/10.3390/ma15061988 (https://doi.org/10.3390/ma15061988)** - 08 Mar 2022

Open Access Article **(/1996-1944/15/6/1987/pdf?version=1647421558)**

Covariates Relating to Implant Failure and Marginal Bone Loss of a Novel Triangular Neck-Implant Placed by Post-Graduate Students: A 1-Year Prospective Cohort Study (/1996-1944/15/6/1987)

Materials **2022**, *15*(6), 1987; **https://doi.org/10.3390/ma15061987 (https://doi.org/10.3390/ma15061987)** - 08 Mar 2022

Open Access Article **(/1996-1944/15/6/1986/pdf?version=1646722410)**

Synthesis of Activated Carbon from *Trachycarpus fortunei* Seeds for the Removal of Cationic and Anionic Dyes (/1996-1944/15/6/1986)

Materials **2022**, *15*(6), 1986; **https://doi.org/10.3390/ma15061986 (https://doi.org/10.3390/ma15061986)** - 08 Mar 2022

Open Access Article **(/1996-1944/15/6/1985/pdf?version=1646719261)**

Superior Radiation Resistance of ZrO_2-Modified W Composites (/1996-1944/15/6/1985)

Materials **2022**, *15*(6), 1985; **https://doi.org/10.3390/ma15061985 (https://doi.org/10.3390/ma15061985)** - 08 Mar 2022

Open Access Article **(/1996-1944/15/6/1984/pdf?version=1646716765)**

Morphological Evolution of TiB_2 and $TiAl_3$ in Al–Ti–B Master Alloy Using Different Ti Adding Routes (/1996-1944/15/6/1984)

Materials **2022**, *15*(6), 1984; **https://doi.org/10.3390/ma15061984 (https://doi.org/10.3390/ma15061984)** - 08 Mar 2022

Open Access Article **(/1996-1944/15/6/1983/pdf?version=1646703025)**

Mineralogical Characteristics and Luminescent Properties of Natural Fluorite with Three Different Colors (/1996-1944/15/6/1983)

Materials **2022**, *15*(6), 1983; **https://doi.org/10.3390/ma15061983 (https://doi.org/10.3390/ma15061983)** - 08 Mar 2022

Show export options

Displaying articles 1-357

Previous Issue
Volume 15, March-1 (/1996-1944/15/5)

Next Issue
Volume 15, April-1 (/1996-1944/15/7)

***Materials* (/journal/materials)**, EISSN 1996-1944, Published by MDPI

RSS (/rss/journal/materials) **Content Alert (/journal/materials/toc-alert)**

Further Information

Article Processing Charges (/apc)
Pay an Invoice (/about/payment)
Open Access Policy (/openaccess)
Contact MDPI (/about/contact)
Jobs at MDPI (https://careers.mdpi.com)

materials

Article

Fabrication and Characterization of Submicron-Scale Bovine Hydroxyapatite: A Top-Down Approach for a Natural Biomaterial

Maria Apriliani Gani [1], Aniek Setiya Budiatin [2], Maria Lucia Ardhani Dwi Lestari [3], Fedik Abdul Rantam [4], Chrismawan Ardianto [2] and Junaidi Khotib [2,*]

1 Doctoral Programme of Pharmaceutical Sciences, Faculty of Pharmacy, Universitas Airlangga, Surabaya 60115, Indonesia; maria.apriliani.gani-2019@ff.unair.ac.id
2 Department of Pharmacy Practice, Faculty of Pharmacy, Universitas Airlangga, Surabaya 60115, Indonesia; anieksb@yahoo.co.id (A.S.B.); chrismawan-a@ff.unair.ac.id (C.A.)
3 Department of Pharmaceutical Science, Faculty of Pharmacy, Universitas Airlangga, Surabaya 60115, Indonesia; maria-lestari@ff.unair.ac.id
4 Laboratory of Virology and Immunology, Faculty of Veterinary Medicine, Universitas Airlangga, Surabaya 60115, Indonesia; fedik-a-r@fkh.unair.ac.id
* Correspondence: junaidi-k@ff.unair.ac.id; Tel.: +62-813-318-40710

Abstract: Submicron hydroxyapatite has been reported to have beneficial effects in bone tissue engineering. This study aimed to fabricate submicron-scale bovine hydroxyapatite (BHA) using the high-energy dry ball milling method. Bovine cortical bone was pretreated and calcined to produce BHA powder scaled in microns. BHA was used to fabricate submicron BHA with milling treatment for 3, 6, and 9 h and was characterized by using dynamic light scattering, scanning electron microscope connected with energy dispersive X-Ray spectroscopy, Fourier-transform infrared spectroscopy, and X-ray diffractometry to obtain its particle size, calcium-to-phosphorus (Ca/P) ratio, functional chemical group, and XRD peaks and crystallinity. Results showed that the particle size of BHA had a wide distribution range, with peaks from ~5 to ~10 µm. Milling treatment for 3, 6, and 9 h successfully gradually reduced the particle size of BHA to a submicron scale. The milled BHA's hydrodynamic size was significantly smaller compared to unmilled BHA. Milling treatment reduced the crystallinity of BHA. However, the treatment did not affect other characteristics; unmilled and milled BHA was shaped hexagonally, had carbonate and phosphate substitution groups, and the Ca/P ratio ranged from 1.48 to 1.68. In conclusion, the fabrication of submicron-scale BHA was successfully conducted using a high-energy dry ball milling method. The milling treatment did not affect the natural characteristics of BHA. Thus, the submicron-scale BHA may be potentially useful as a biomaterial for bone grafts.

Keywords: submicron material; nanomaterial; bone scaffold; bone graft; calcium phosphate; neglected disease

check for updates

Citation: Gani, M.A.; Budiatin, A.S.; Lestari, M.L.A.D.; Rantam, F.A.; Ardianto, C.; Khotib, J. Fabrication and Characterization of Submicron-Scale Bovine Hydroxyapatite: A Top-Down Approach for a Natural Biomaterial. *Materials* **2022**, *15*, 2324. https://doi.org/10.3390/ma15062324

Academic Editors: Swarup Roy and Antonio Scarano

Received: 8 February 2022
Accepted: 19 March 2022
Published: 21 March 2022

1. Introduction

Bone defects represent a neglected form of disease that may severely interfere with the physiological function of bones [1–3]. This form of disease may also affect an individual's quality of life and the patient's economic burden [1]. Every year, more than 2.2 million people globally undergo bone grafting procedures to treat bone defects [4]. Therefore, the development of osteoconductive biomaterial should focus on bone tissue engineering to accelerate bone defect repairs.

The development of nanoscale materials has been rapidly increasing in recent decades. Nanoscale biomaterials have been reported to have beneficial effects in bone tissue engineering, such as increasing the adhesion, differentiation, and proliferation of osteoblasts and providing vascularization and bone formation in vivo [5,6]. However, the effects of nanomaterials, particularly in osteoclasts, were not as expected in osteoblasts. Chen et al. [7] reported that HA in nanoscale grain sizes (~100 nm) impaired osteoclastic formation and function. This was evidenced by inhibited cell fusion, reduced osteoclast size, increased osteoclast apoptosis, suppressed expression of osteoclast specific genes and proteins, and hampered resorption activity compared to submicron HA (~500 nm). Other than that, nanoparticles smaller than 10 nm were indicated to act similar to gas and may cross various biological barriers, reaching sensitive organs and disturbing normal cell behavior [8,9].

Furthermore, the study begins to report the beneficial effect of submicron +−scale material for bone reconstruction. The submicron +-scale material was also found to be the most influential surface dimension in promoting osteoblast differentiation, as reported by Khang et al. [10]. In addition, submicron-scale ceramic (grain size: ~800 nm) was observed to enhance bone regeneration after 12 weeks of implantation [11]. Particularly in regard to osteoclasts, it has been reported that hydroxyapatite with a particle size of ~500 nm beneficially influences osteoclast formation and function compared to smaller-sized materials [7]. Thus, considering the controversy of material sizes, it is suggested that the submicron-scale materials potentially have superior action on bone cells, particularly osteoclasts, and may be combined with other ceramics to produce desired characteristics for bone tissue regeneration [12–15].

Hydroxyapatite (HA) is a derivate of calcium phosphate that is widely used for medical purposes, including orthopedic and dental [16]. HA as a biomaterial can be synthesized from chemical precursors known as synthetic HA or extracted from natural sources such as mammalian bones [16]. One advantage in using natural HA compared to synthetic HA is the characteristics of natural HA. Natural HA, such as bovine hydroxyapatite (BHA), has a carbonate substitution group on its apatite. The natural HA is similar to human bone and was not found in synthetic HA [17–19]. Carbonated HA was found to increase osteoblast proliferation in vitro [20]. Other characteristics of BHA, such as its high compressive strength, prevent premature degradation and support bone formation in vivo [16,21].

Considering the beneficial effects of BHA and submicron material in bone tissue engineering, the development of submicron BHA potentially increases the osteoinductive and osteoconductive properties of BHA. As it was established that submicron material had a superior effect on osteoclasts [7], submicron BHA will also benefit bone diseases related to osteoclast dysfunction.

Studies have reported that critical parameters must be considered when fabricating hydroxyapatite [13,14,22,23]. Due to the high compressive strength property of BHA, an appropriate method should be chosen to reduce the particle size of the BHA. A previous study by Ruksudjarit et al. [24] synthesized a nano-hydroxyapatite using the wet ball milling method with ethanol as the milling media. Ethanol is widely used as a process control agent (PCA) in the milling process of biomaterials [25]. However, the use of ethanol and other organic solvents is known to be the most common source of contamination of obtained materials. These solvents reduced crystallinity, and also changed the morphology and distribution of elements of the starting materials [26,27]. Because of this, it is suggested that the use of organic compounds should be avoided in the milling treatment of biomaterials.

This study aimed to fabricate submicron-scale HA by using high-energy dry ball milling. In this study, bovine bones were given pretreatment (boiled, dried, and calcined) in order to obtain BHA. BHA naturally sized in microns was milled for several hours by using the high-energy dry ball milling method. Milled and unmilled BHA then were characterized by using dynamic light scattering (DLS, Beckman Coulter, Indianapolis, IN, USA), a scanning electron microscope connected with energy dispersive X-Ray spectroscopy (SEM-EDX, Carl Zeiss, Oberkochen, Germany), Fourier-transform infrared spectroscopy (FTIR, Bruker, Leipzig, Germany), and X-ray diffractometry (XRD, PANAlytical Corporation, Almelo, The Netherland). Submicron-scale BHA with innate characteristics of human bone has the potential to be used for bone grafts or drug delivery systems to bone tissues.

2. Materials and Methods

2.1. Extraction of Bovine Hydroxyapatite

BHA was extracted based on the methods used by Budiatin et al. [18], with modifications. The raw material was fresh cortical bone from mature bovines. Bone was cut and cleaned with water, and spongy parts and bone marrow were removed. Furthermore, the bone was boiled for 5 h in distilled water (distilled water was changed every hour). Bone was boiled in the pressurized tank for 3 h (water was changed every one hour). The boiled bone was then dried at 60 °C for three hours. The dried bone was soaked in absolute ethanol (Brataco Chemika, Surabaya, Indonesia) for 24 h while being shaken (ethanol was changed every 12 h). Calcination was conducted for two hours at 1000 °C. Finally, the bone was ground and sieved through an 80-mesh sieve.

This study also examined the BHA-based and HA-based scaffold's compressive strength. The scaffolds were made from extracted BHA and HA (CASs number 1306-06-5, molecular weight 1004.6 g mol^{-1}; further characteristics are present in Figure S1). Briefly, BHA or HA (10 g) was added to 5 mL of a prepared 20% gelatin solution (Cartino, Samut Prakan, Thailand). The mixture was stirred and sieved using a mesh (size: 1.0 mm) and dried at 37 °C. Next, 25 mg of granules were molded into an implant (diameter: 2 mm) using a hydraulic press (2 ton; Graseby-Specac Ltd., Orpington, Kent, London, UK).

2.2. Fabrication of Submicron-Scale BHA Using High-Energy Dry Milling

The fabrication of submicron-scale BHA was conducted based on the methods of Aminatun et al. (2019) [27]. BHA extracted from the previous method was used as the starting material. A milling ball made from alumina was used; the ratio of BHA and the milling ball was 1:20. The milling treatment was conducted for three, six, and nine hours in the milling vial.

2.3. Material Characterization

The compressive strength of the BHA-based and HA-based scaffolds was characterized by using a mini autograph (Autograph Microcomputer Control Universal Testing, LoadCell, YXC-1B (Original Equipment Manufacture, Surabaya, Indonesia), speed 5 mm/min).

The Ca/P ratio of materials was examined using SEM-EDX (EVO MA 10; Carl Zeiss, Oberkochen, Germany). The structural evaluation of particle size was examined using the same instrument and analyzed by measuring the mean particle size in at least two different axes using the ImageJ 1.52a software (National Institutes of Health, Bethesda, MD, USA).

The crystallinity of the materials was examined by using XRD (PANalytical X'Pert^3 powder; PANAlytical Corporation, Almelo, The Netherland). The XRD pattern was corrected, and the XRD peaks were detected using Origin software (OriginLab Corporation, Northampton, MA, USA). The percent of crystallinity of each material was calculated based on area under peaks by using Origin software.

$$\text{Percent of crystallinity} : \frac{\text{Acrytalline}}{\text{Acrytalline} + \text{Aamorphous}} \times 100\% \quad (1)$$

The hydrodynamic particle size of materials was measured by using DLS (Delsa™ Nano C; Beckman Coulter, Indianapolis, IN, USA), while the functional chemical group of each material was examined with FTIR (Alpha II; Bruker, Leipzig, Germany).

3. Results

Prior to the fabrication and characterization of the material, a compressive strength test was conducted to compare the strength of BHA as natural form of HA with a synthetic HA (characteristics of HA are presented in Figure S1). Figure 1 shows that BHA had a higher compressive strength than the synthetic HA ($p = 0.0254$; unpaired t-test). This indicated that BHA is a compact material compared to HA.

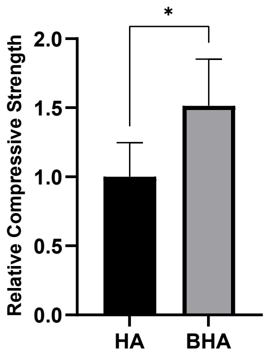


Figure 1. Relative compressive strength of BHA and HA. Each bar shows the mean ± *SD* ratio. * $p < 0.05$ based on the unpaired *t*-test.

The strength of BHA indicated its brittleness, which may affect the submicron-BHA fabrication process. Thus, an appropriate method should be considered in the top-down fabrication process for BHA. In the current study, we chose the high-energy dry ball milling method to fabricate submicron BHA. Figure 2C shows that the particle size of unmilled BHA had a wide distribution range, from submicrons to ~30 µm, with a peak of ~5 to ~10 µm. Moreover, SEM images presented in Figure 2 also show that milling treatment reduced the particle size of BHA, both qualitatively and semiquantitatively. BHA samples milled for three, six, and nine hours were measured and found to have particle sizes of ~3, ~1 µm, and in the submicron scale (Figure 2F,I,L). Moreover, all material was shaped hexagonally (Figure 2); this shape of BHA also differentiates BHA from synthetic HA (Figure S1A,B).

Milling treatment did not affect the characteristics of BHA based on its functional chemical groups. FTIR spectra showed that all materials had carbonate and phosphate groups present at a wavenumber of 1455 cm^{-1} and 1000–1100 cm^{-1}, respectively (Figure 3). Moreover, the carbonate group detected in all BHA samples was not present in HA (Figure S1C). The XRD pattern and peaks of unmilled and milled BHA are presented in Figure 4. BHA had 84.02% crystallinity, while BHA milled for 3, 6, and 9 h had 65.81%, 60.98%, and 60.70% crystallinity, respectively. In addition, the calcium-to-phosphorus (Ca/P) of unmilled and milled BHA ranged from 1.48 to 1.68 (Table 1). The Ca/P of all BHA samples (unmilled and milled) is higher than that found in synthetic HA (Figure S1E).

The current study also conducted a hydrodynamic particle measurement of the unmilled and milled BHA (Figure 5). This measurement was essential to predict the in vivo performance of BHA as submicron materials. In line with previous results by SEM (Figure 2), the milling treatment reduced the particle size of BHA over time. However, the hydrodynamic size of milled BHA was more extensive; the particle size was scaled in micron size with BHA milled for nine hours being the smallest.

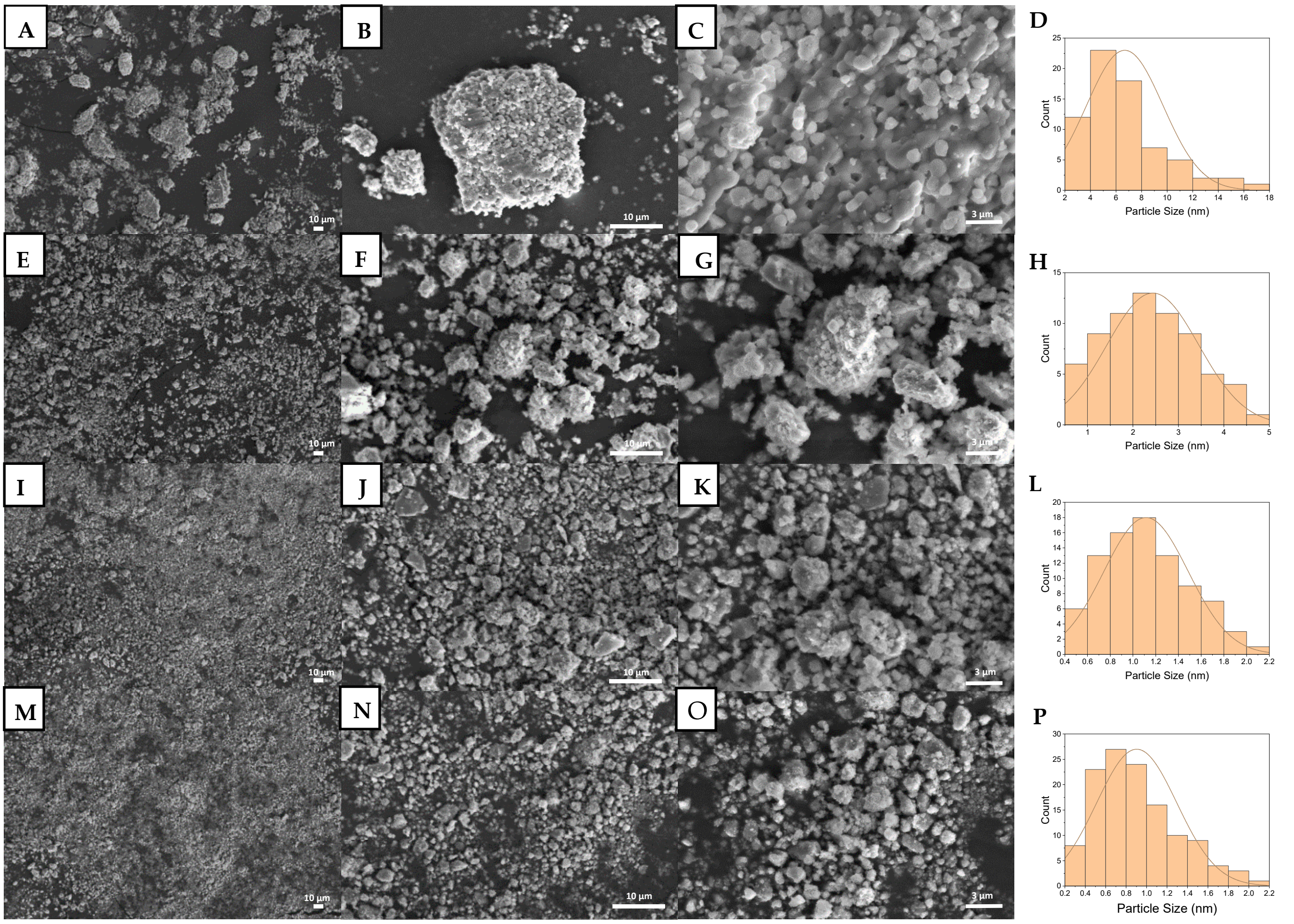


Figure 2. SEM images and particle size distribution of unmilled BHA (**A**–**D**), BHA milled for 3 h (**E**–**H**), BHA milled for 6 h (**I**–**L**), and BHA milled for 9 h (**M**–**P**). (**A**,**E**,**I**,**M**) Images show total magnification of 1000×. (**B**,**F**,**J**,**N**) Images show total magnification of 5000×. (**C**,**G**,**K**,**O**) Images show total magnification of 15,000×. (**D**,**H**,**L**,**P**) Graphs show the corresponding particle size distributions.

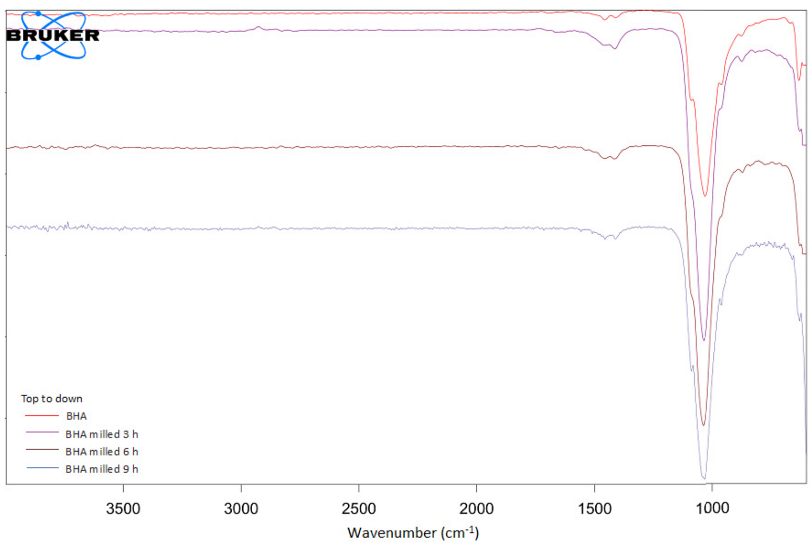


Figure 3. FTIR spectra of unmilled and milled BHA.

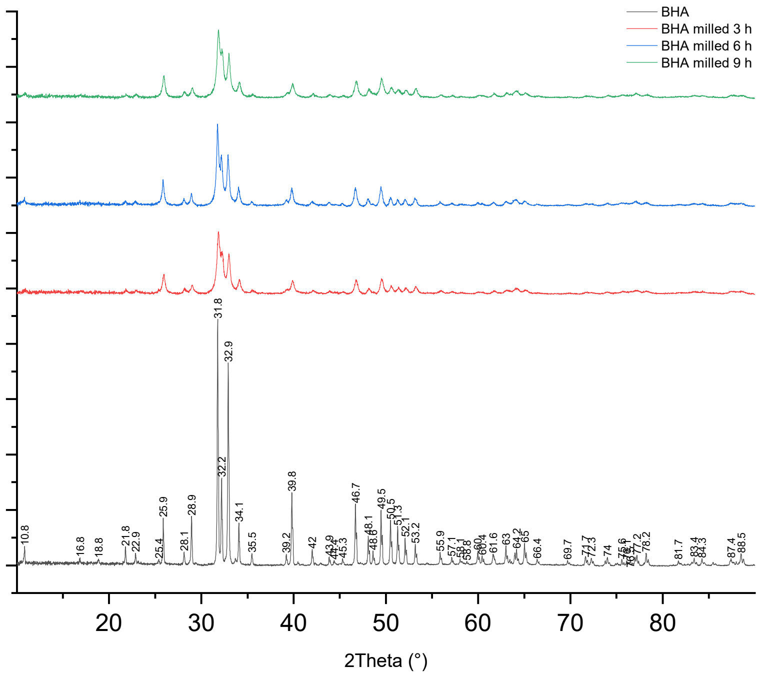


Figure 4. XRD spectra of unmilled and milled BHA.

Table 1. Ca/P ratio of unmilled and milled BHA.

Material	Calcium (Ca)		Phosphorus (P)		Ca/P Ratio
	Weight (%)	Atomic (%)	Weight (%)	Atomic (%)	
BHA	68.01	62.16	31.99	37.84	1.64
BHA milled 3 h	68.43	62.62	31.57	37.38	1.68
BHA milled 6 h	65.70	59.69	34.30	40.21	1.48
BHA milled 9 h	65.95	59.95	34.05	40.05	1.50

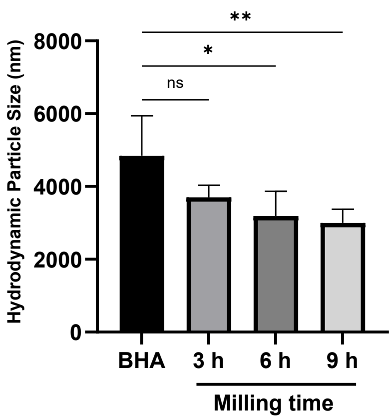


Figure 5. The hydrodynamic particle size of milled and unmilled BHA. Each bar shows the mean ± *SD* value. * $p < 0.05$, ** $p < 0.01$ based on a one-way ANOVA test.

4. Discussion

The current study was conducted to fabricate submicron-scale BHA using the dry ball milling method with various milling times. This milling method uses no media in the milling treatment of materials. Milling media such as ethanol and other organic solvent are widely used as PCA in the milling method [28–30]. PCA functions to avoid cold welding and bonding between the powder particles. However, PCA is also known to change material characteristics [25]. In the case of the milling treatment of BHA, the use of PCA may change its natural characteristics, which is not desirable. In the current study, we did not vary the milling speed because it was previously reported that milling speed did not influence the particle size of materials [31,32]. Although BHA is a material with high compressive strength, our study proved that a 9-h milling treatment successfully reduced the particle size of BHA to a submicron scale without changing the natural morphology of BHA. The hydrodynamic size of these materials was higher; however, the particle size of milled BHA was significantly smaller than unmilled BHA.

Our currently fabricated submicron BHA has been indicated to have a beneficial effect in bone tissue engineering. A previous study reported that submicron-scale materials (~500 nm) had a beneficial effect on osteoclast formation and function compared to nanomaterials [7]. This event is suggested to occur through the integrin–ligand protein interactions by protein adsorption [10]. In addition, submicron-sized ceramics (grain size: ~800 nm) have also been proven to enhance bone regeneration compared to microscale ceramics (grain size: ~2.5 µm) after 12 weeks of implantation in vivo [11].

Furthermore, our current study also proved that the milling treatment did not change the morphology of BHA. The morphology of these materials was similar to bovine-derived HA in our previous study [18] and the hydrogel composite HA in the study of Slota et al. [33]. This hexagonal-like morphology of biomaterials was reported to promote osteoblast adhesion after five hours of seeding [33]. This morphology is also present in the biomineralization of human bone mesenchymal stem cells [34], suggesting similar properties and better performance in vivo.

Moreover, our current study proved that the top-down treatment did not affect the characteristics of BHA based on its chemical functional groups. Both unmilled and milled BHA showed carbonate and phosphate chemical groups. This was similar to our previous study [18] and another study conducted by Michelot et al. [35]. The carbonate group in HA was reported to accelerate the differentiation and proliferation of osteoprogenitor cells to bone cells compared to uncarbonated HA [20]. Moreover, the carbonated HA was also reported to increase the gene expression of the collagen matrix [36]. In vivo studies also showed that carbonated HA, such as BHA, exhibited higher presentation of new bone formation and higher bone-to-material contact when compared to other types of HA [37,38].

Our current study also found that milling treatment reduced the crystallinity of BHA. Reductions in material crystallinity generally occurs because of milling treatment, such as reported by Ma et al. [39]. The study reported that a high-energy milling treatment reduced the crystallinity of MgCu. This incident is related to grain refinement and the impingement of milling balls with material, which decreased XRD peaks [39].

The Ca/P of human bone is generally considered to have a theoretical Ca/P ratio of 1.67 [40]. In the current study, we also examined the Ca/P of materials. This study showed that the Ca/P ratio of all materials was close to human HA [40]. Furthermore, the Ca/P ratio of 1.67 is also widely used as a reference value for bone grafts, rendering it suitable for orthopedic, dental, and maxillofacial implants [41,42]. Thus, the Ca/Pa value of fabricated submicron BHA supported the potential of this material to be used for bone implants. Moreover, calcium and phosphate play essential roles in bone tissue formation. Calcium ions stimulate the osteoblastic bone synthesis pathway, affects osteoblasts' life span, and regulate the formation and the resorptive functions of osteoclasts. On the other hand, phosphate regulates the differentiation and growth of osteoblastic lineage, increases the expression of bone morphogenetic proteins, and plays a role in the maturation of osteocytes [43,44].

To the best of our knowledge, our current study is the first study that considers the milling treatment of hard and dense natural HA without PCA. The non-hazardous method of milling treatment used in this study reduced the natural particle size of the material without affecting its characteristics. Considering the beneficial effects of submicron material and the characteristics of natural HA, submicron-sized natural HA may have beneficial effects in bone tissue engineering.

5. Conclusions

Submicron-scale natural HA fabrication was successfully conducted using a high-energy dry ball milling method. A milling time of 9 h decreased the particle size of BHA from micron to submicron scale. The milling treatment did not affect the natural characteristics of BHA marked by the morphology, chemical group substitution, crystallinity, and Ca/P ratio of the material. Thus, the submicron-scale BHA with innate characteristics of human bone may be potentially used as a biomaterial that could possibly have better in vitro and in vivo performance. However, further research regarding this should be proven in further studies.

Supplementary Materials: The following supporting information can be downloaded at https://www.mdpi.com/article/10.3390/ma15062324/s1, Figure S1: Characteristics of synthetic HA.

Author Contributions: Conceptualization: M.A.G. and J.K.; methodology: A.S.B. and M.L.A.D.L.; software: M.A.G. and C.A.; validation: M.A.G. and J.K.; formal analysis: M.A.G.; investigation: M.A.G.; resources: A.S.B., M.L.A.D.L. and J.K.; data curation: M.A.G.; writing—original draft preparation: M.A.G.; writing—review and editing: M.A.G. and J.K.; visualization: M.A.G.; supervision: F.A.R., C.A. and J.K.; project administration: M.A.G. and A.S.B.; funding acquisition: J.K. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by the Ministry of Education and Culture of the Republic of Indonesia, through PMDSU research scheme (grant number: 578/UN3.15/PT/2021).

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Acknowledgments: The authors thank the Faculty of Pharmacy, Universitas Airlangga, for all of the support during the research.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Worm, P.V.; Finger, G.; Ludwig do Nascimento, T.; Rynkowski, C.B.; Collares, M.V.M. The impact of cranioplasty on the patients' quality of life. *J. Cranio-Maxillofac. Surg.* **2019**, *47*, 715–719. [CrossRef] [PubMed]
2. Gani, M.A.; Nurhan, A.D.; Budiatin, A.S.; Siswodihardjo, S.; Khotib, J. Predicting the molecular mechanism of glucosamine in accelerating bone defect repair by stimulating osteogenic proteins. *J. Basic Clin. Physiol. Pharmacol.* **2021**, *32*, 373–377. [CrossRef] [PubMed]
3. Khotib, J.; Utami, N.W.; Gani, M.A.; Ardianto, C. The change of proinflammatory cytokine tumor necrosis factor α level in the use of meloxicam in rat model of osteoarthritis. *J. Basic Clin. Physiol. Pharmacol.* **2019**, *30*, 1–8. [CrossRef] [PubMed]
4. Javaid, M.A.; Kaartinen, M.T. Mesenchymal Stem Cell-based Bone Tissue Engineering. *Int. Dent. J. Stud. Res.* **2013**, *1*, 24–35.
5. Ha, S.W.; Park, J.; Habib, M.M.; Beck, G.R. Nano-Hydroxyapatite Stimulation of Gene Expression Requires Fgf Receptor, Phosphate Transporter, and Erk1/2 Signaling. *ACS Appl. Mater. Interfaces* **2017**, *9*, 39185–39196. [CrossRef]
6. Da Silva Brum, I.; de Carvalho, J.J.; da Silva Pires, J.L.; de Carvalho, M.A.A.; dos Santos, L.B.F.; Elias, C.N. Nanosized hydroxyapatite and β-tricalcium phosphate composite: Physico-chemical, cytotoxicity, morphological properties and in vivo trial. *Sci. Rep.* **2019**, *9*, 19602. [CrossRef]
7. Chen, F.; Wang, M.; Wang, J.; Chen, X.; Li, X.; Xiao, Y.; Zhang, X. Effects of hydroxyapatite surface nano/micro-structure on osteoclast formation and activity. *J. Mater. Chem. B* **2019**, *7*, 7574–7587. [CrossRef]
8. Vishwakarma, V.; Samal, S.S.; Manoharan, N. Safety and Risk Associated with Nanoparticles—A Review. *J. Miner. Mater. Charact. Eng.* **2010**, *09*, 455–459. [CrossRef]
9. Pourmand, A.; Abdollahi, M. Current opinion on nanotoxicology. *DARU J. Pharm. Sci.* **2012**, *20*, 2–4. [CrossRef]
10. Khang, D.; Choi, J.; Im, Y.M.; Kim, Y.J.; Jang, J.H.; Kang, S.S.; Nam, T.H.; Song, J.; Park, J.W. Role of subnano-, nano- and submicron-surface features on osteoblast differentiation of bone marrow mesenchymal stem cells. *Biomaterials* **2012**, *33*, 5997–6007. [CrossRef]
11. Duan, R.; Barbieri, D.; Luo, X.; Weng, J.; de Bruijn, J.D.; Yuan, H. Submicron-surface structured tricalcium phosphate ceramic enhances the bone regeneration in canine spine environment. *J. Orthop. Res.* **2016**, *34*, 1865–1873. [CrossRef] [PubMed]
12. Sabzi, M.; Far, S.M.; Dezfuli, S.M. Characterization of bioactivity behavior and corrosion responses of hydroxyapatite-ZnO nanostructured coating deposited on NiTi shape memory alloy. *Ceram. Int.* **2018**, *44*, 21395–21405. [CrossRef]

13. DileepKumar, V.G.; Sridhar, M.S.; Aramwit, P.; Krut'ko, V.K.; Musskaya, O.N.; Glazov, I.E.; Reddy, N. A review on the synthesis and properties of hydroxyapatite for biomedical applications. *J. Biomater. Sci. Polym. Ed.* **2022**, *33*, 229–261. [CrossRef] [PubMed]
14. Antoniac, I. *Bioceramics and Biocomposites: From Research to Clinical Practice*; John Wiley & Sons: Hoboken, NJ, USA, 2019.
15. Antoniac, I.V. Handbook of bioceramics and biocomposites. *Handb. Bioceram. Biocomposites* **2016**, 1–1386. [CrossRef]
16. Khotib, J.; Gani, M.A.; Budiatin, A.S.; Lestari, M.L.A.D.; Rahadiansyah, E.; Ardianto, C. Signaling Pathway and Transcriptional Regulation in Osteoblasts during Bone Healing: Direct Involvement of Hydroxyapatite as a Biomaterial. *Pharmaceuticals* **2021**, *14*, 615. [CrossRef] [PubMed]
17. Rana, M.; Akhtar, N.; Rahman, S.; Jamil, H.M.; Asaduzzaman, S.M. Extraction of Hydroxyapatite from Bovine and Human Cortical Bone by Thermal Decomposition and Effect of Gamma Radiation: A Comparative Study. *Int. J. Complement. Altern. Med.* **2017**, *8*, 263. [CrossRef]
18. Budiatin, A.S.; Samirah; Gani, M.A.; Nilamsari, W.P.; Ardianto, C.; Khotib, J. The characterization of bovine bone-derived hydroxyapatite isolated using novel non-hazardous method. *J. Biomim. Biomater. Biomed. Eng.* **2020**, *45*, 49–56. [CrossRef]
19. Budiatin, A.S.; Gani, M.A.; Ardianto, C.; Samirah; Pattah, S.Y.D.; Mubarokah, F.; Khotib, J. The impact of glutaraldehyde on the characteristics of bovine hydroxyapatite-gelatin based bone scaffold as gentamicin delivery system. *J. Basic Clin. Physiol. Pharmacol.* **2021**, *32*, 687–691. [CrossRef]
20. Germaini, M.-M.; Detsch, R.; Grünewald, A.; Magnaudeix, A.; Lalloue, F.; Boccaccini, A.R.; Champion, E. Osteoblast and osteoclast responses to A/B type carbonate-substituted hydroxyapatite ceramics for bone regeneration This. *Biomed. Mater.* **2017**, *12*, 035008. [CrossRef]
21. Budiatin, A.S.; Gani, M.A.; Samirah; Ardianto, C.; Raharjanti, A.M.; Septiani, I.; Putri, N.P.K.P.; Khotib, J. Bovine Hydroxyapatite-Based Bone Scaffold with Gentamicin Accelerates Vascularization and Remodeling of Bone Defect. *Int. J. Biomater.* **2021**, *2021*, 5560891. [CrossRef]
22. Sabzi, M.; Mousavi Anijdan, S.H.; Ghobeiti-Hasab, M.; Fatemi-Mehr, M. Sintering variables optimization, microstructural evolution and physical properties enhancement of nano-WC ceramics. *J. Alloys Compd.* **2018**, *766*, 672–677. [CrossRef]
23. Mujahid, M.; Sarfraz, S.; Amin, S. On the formation of hydroxyapatite nano crystals prepared using cationic surfactant. *Mater. Res.* **2015**, *18*, 468–472. [CrossRef]
24. Ruksudjarit, A.; Pengpat, K.; Rujijanagul, G.; Tunkasiri, T. Synthesis and characterization of nanocrystalline hydroxyapatite from natural bovine bone. *Curr. Appl. Phys.* **2008**, *8*, 270–272. [CrossRef]
25. Janovszky, D. Influence of the oxide and ethanol surface layer on phase transformation of Al-based nanocomposite powders under high-energy milling. *Materials* **2019**, *12*, 1305. [CrossRef] [PubMed]
26. Rocha, C.J.; Leal Neto, R.M.; Gonçalves, V.S.; Carvalho, L.L.; Ambrozio Filho, F. An investigation of the use of stearic acid as a process control agent in high energy ball milling of Nb-Al and Ni-Al powder mixtures. *Mater. Sci. Forum* **2003**, *416–418*, 144–149. [CrossRef]
27. Aminatun; Supardi, A.; Nisa, Z.I.; Hikmawati, D. Siswanto Synthesis of Nanohydroxyapatite from Cuttlefish Bone (Sepia sp.) Using Milling Method. *Int. J. Biomater.* **2019**, *2019*, 1831208. [CrossRef]
28. Yazdani, N.; Toroghinejad, M.R.; Shabani, A.; Cavaliere, P. Effects of process control agent amount, milling time, and annealing heat treatment on the microstructure of alcrcufeni high-entropy alloy synthesized through mechanical alloying. *Metals* **2021**, *11*, 1493. [CrossRef]
29. Matuła, I.; Zubko, M.; Dercz, G. Role of Sn as a process control agent on mechanical alloying behavior of nanocrystalline titanium based powders. *Materials* **2020**, *13*, 2110. [CrossRef]
30. Gopalan, A.; Lee, J.-C.; Saianand, G.; Lee, K.; Chun, W.; Hou, Y.; Kannan, V.; Park, S.; Kim, W. Cost-Effective Production of TiO_2 with 90-Fold Enhanced Photocatalytic Activity Via Facile Sequential Calcination and Ball Milling Post-Treatment Strategy. *Materials* **2020**, *13*, 5072. [CrossRef]
31. Biyik, S.; Aydin, M. The effect of milling speed on particle size and morphology of Cu25W composite powder. *Acta Phys. Pol. A* **2015**, *127*, 1255–1260. [CrossRef]
32. Hussain, I.; Lee, J.E.; Jeon, S.E.; Cho, H.J.; Huh, S.H.; Koo, B.H.; Lee, C.G. Effect of milling speed on the structural and magnetic properties of Ni70Mn30 alloy prepared by Planetary Ball Mill method. *Korean J. Mater. Res.* **2018**, *28*, 539–543. [CrossRef]
33. Slota, D.; Głąb, M.; Tyliszczak, B.; Dogulas, T.E.L.; Rudnicka, K.; Miernik, K.; Urbaniak, M.M.; Rusek-Wala, P.; Sobczak-upiec, A. Composites based on hydroxyapatite and whey protein isolate for applications in bone regeneration. *Materials* **2021**, *14*, 2317. [CrossRef]
34. Procopio, A.; Malucelli, E.; Pacureanu, A.; Cappadone, C.; Farruggia, G.; Sargenti, A.; Castiglioni, S.; Altamura, D.; Sorrentino, A.; Giannini, C.; et al. Chemical Fingerprint of Zn–Hydroxyapatite in the Early Stages of Osteogenic Differentiation. *ACS Cent. Sci.* **2019**, *5*, 1449–1460. [CrossRef] [PubMed]
35. Michelot, A.; Sarda, S.; Audin, C.; Deydier, E.; Manoury, E.; Poli, R.; Rey, C. Spectroscopic characterisation of hydroxyapatite and nanocrystalline apatite with grafted aminopropyltriethoxysilane: Nature of silane–surface interaction. *J. Mater. Sci.* **2015**, *50*, 5746–5757. [CrossRef]
36. Rupani, A.; Hidalgo-Bastida, L.A.; Rutten, F.; Dent, A.; Turner, I.; Cartmell, S. Osteoblast activity on carbonated hydroxyapatite. *J. Biomed. Mater. Res. Part A* **2012**, *100*, 1089–1096. [CrossRef]
37. Xu, A.; Zhou, C.; Qi, W.; He, F. Comparison Study of Three Hydroxyapatite-Based Bone Substitutes in a Calvarial Defect Model in Rabbits. *Int. J. Oral Maxillofac. Implants* **2019**, *34*, 434–442. [CrossRef]

38. Lambert, F.; Bacevic, M.; Layrolle, P.; Schüpbach, P.; Drion, P.; Rompen, E. Impact of biomaterial microtopography on bone regeneration: Comparison of three hydroxyapatites. *Clin. Oral Implants Res.* **2017**, *28*, 201–207. [CrossRef] [PubMed]
39. Ma, Z.; Liu, Y.; Yu, L.; Cai, Q. Correction: Investigation of phase composition and nanoscale microstructure of high-energy ball-milled mgcu sample. *Nanoscale Res. Lett.* **2013**, *8*, 1. [CrossRef] [PubMed]
40. Young, R.A. Biological apatite vs hydroxyapatite at the atomic level. *Clin. Orthop. Relat. Res.* **1975**, *113*, 249–262. [CrossRef] [PubMed]
41. Bhattacharjee, A.; Fang, Y.; Hooper, T.J.N.; Kelly, N.L.; Gupta, D.; Balani, K.; Manna, I.; Baikie, T.; Bishop, P.T.; White, T.J.; et al. Crystal chemistry and antibacterial properties of cupriferous hydroxyapatite. *Materials* **2019**, *12*, 1814. [CrossRef]
42. Eliaz, N.; Metoki, N. Calcium phosphate bioceramics: A review of their history, structure, properties, coating technologies and biomedical applications. *Materials* **2017**, *10*, 334. [CrossRef] [PubMed]
43. Jeong, J.; Kim, J.H.; Shim, J.H.; Hwang, N.S.; Heo, C.Y. Bioactive calcium phosphate materials and applications in bone regeneration. *Biomater. Res.* **2019**, *23*, 18–28. [CrossRef] [PubMed]
44. Bonjour, J.P. Calcium and phosphate: A duet of ions playing for bone health. *J. Am. Coll. Nutr.* **2011**, *30*, 438S–448S. [CrossRef] [PubMed]

also developed by scimago: SCIMAGO INSTITUTIONS RANKINGS

SJR Scimago Journal & Country Rank

Home Journal Rankings Country Rankings Viz Tools Help About Us

Materials

COUNTRY

Switzerland

Universities and research institutions in Switzerland

Media Ranking in Switzerland

PUBLISHER

MDPI AG

H-INDE

1
8

SUBJECT AREA AND CATEGORY

Materials Science
- Materials Science (miscellaneous)

Physics and Astronomy
- Condensed Matter Physics

PUBLICATION TYPE

Journals

ISSN

19961944

COVERAGE

2008-2021

INFORI

Home

How to publis this jo

marya izian@ .ca

SCOPE

Materials (ISSN 1996-1944) is an open access journal of related scientific research and technology development. It publishes reviews, regular research papers (articles) and short communications. Our aim is to encourage scientists to publish their experimental and theoretical results in as much detail as possible. Therefore, there is no restriction on the length of the The full experimental details must be provided so that the results can be reproduced. Materials provides a forum for publishing papers which advance the in-depth understanding of the relationship between the structure, the properties or the functions of all kinds of materials. Chemical syntheses, chemical structures and mechanical, chemical, electronic, magnetic and opt properties and various applications will be considered. Topics Covered: -Class of materials include ceramics, glasses, polymers (plastics), semiconductors, magnetic materials, medical imp materials and biological materials, silica and carbon materials, metals and metallic alloys. All kinds of functional materials including material for dentistry. Composites, coatings and films, pigments. Classes of materials such as ionic crystals; covalent crystals; metals; intermetallics. -Materials science or materials engineering. Nanoscience and nanotechnology will be consid

Join the conversation about this journal

Quartiles

FIND SIMILAR JOURNALS

options

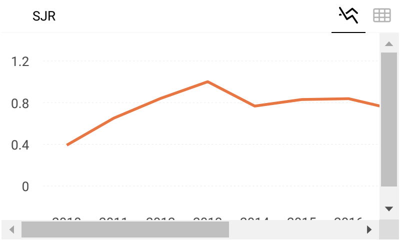
1
Cailiao Daobao/Materials Review
CHN
71%
similarity

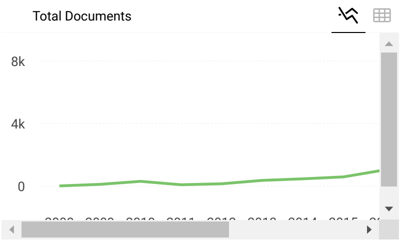
2
Materials Express
USA
64%
similarity

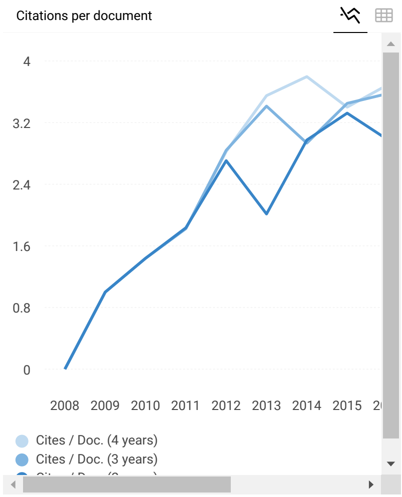
3
Materials Research Express
GBR
62%
similarity

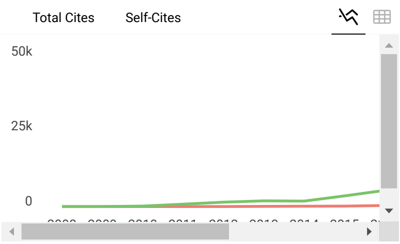
4
Journal Wuhan University of Technology, Materials
CHN
60%
similarity

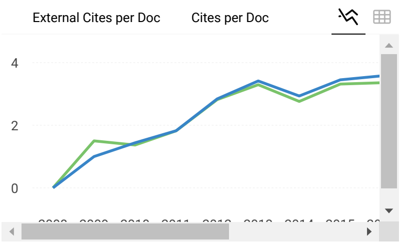
5
Materials Today Communications
NLD
60%
similarity

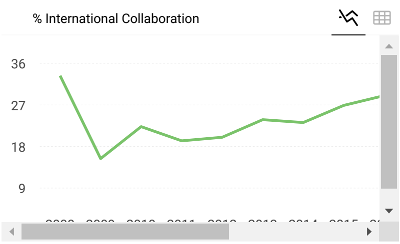


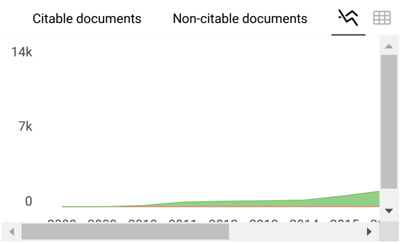


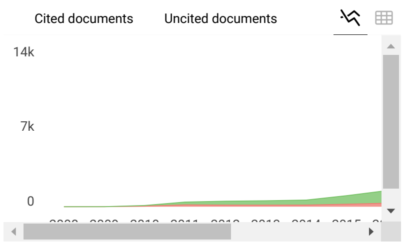












← Show this widget in your own website

Just copy the code below and paste within your html code:

<a href="https://www.scimag

SCImago Graphica

Explore, visually communicate and make sense of data with our **new data visualization tool.**