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The Effect of Photoconductive Mole Fraction Based on Thin Film $Ba_xSr_{1-x}TiO_3$ ($x = 0.000; 0.125; 0.250; 0.375; 0.500$) on Electrical Properties and Diffusivity Coefficient

Irzaman ^{1,*}, Vania Rahmawaty ¹, Endah Kinarya Palupi ¹, Nazopatul Patonah ¹, Tony Sumaryada ¹, Ridwan Siskandar ², Husin Alatas ¹, Muhammad Iqbal ³, Brian Yulianto ³, Mochammad Zakki Fahmi ⁴, Febdian Rusydi ⁵, Widagdo Sri Nugroho ⁶

¹ Department of Physics, Faculty of Mathematics and Science, Bogor Agricultural University, Meranti Street, Dramaga, Bogor, West Java, 16680, Indonesia

² Computer Engineering Study Program, College of Vocational Studies, IPB University, Bogor, West Java 16151, Indonesia; ridwansiskandar@apps.ipb.ac.id (R.S.);

³ Department of Engineering Physics, Industrial Engineering Faculty, Bandung Institute of Technology, Bandung, West Java 40132, Indonesia; iqbal@tf.itb.ac.id (M.I.); brian@tf.itb.ac.id (B.Y.);

⁴ Department of Chemistry, Faculty of Science and Technology, Airlangga University Surabaya, East Java 60115, Indonesia; m.zakki.fahmi@fst.unair.ac.id (M.Z.F.);

⁵ Department of Physics, Faculty of Science and Technology, Airlangga University Surabaya, East Java 60115, Indonesia

⁶ Department of Veterinary Public Health, Faculty of Veterinary Medicine, Universitas Gadjah Mada, Yogyakarta, Indonesia; weesnugroho@ugm.ac.id (W.S.N.);

* Correspondence: irzaman@apps.ipb.ac.id;

Scopus Author ID 7409571162

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Abstract: Barium Strontium Titanate ($Ba_xSr_{1-x}TiO_3$) thin films have been fabricated for mole fraction ($x = 0.000; 0.125; 0.250; 0.375; 0.500$) on p-type silicon (100) substrate using Chemical Solution Deposition (CSD) method and spin coating technique. The film annealed at 850 °C for 8 hours with an increasing rate of 1.67 °C/minute. The BST thin film was characterized using an LCR meter that the film is given a different light intensity (0 lux, 4000 lux, 8000 lux). Data obtained from the LCR meter is conductance, capacitance, and impedance. Different mole fractions on Barium produce different electrical properties that show the value of electric conductivity, dielectric constant, impedance, and diffusion coefficient.

Keywords: $Ba_xSr_{1-x}TiO_3$; mole fraction; electrical properties; diffusivity coefficient; LCR meter.

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1. Introduction

In recent years, increasing attention has been paid to the synthesis and characterization of barium strontium titanate (BST) because its uniqueness lies in its mole fraction, which can be varied and cause new chemical and physical properties. Partial substitution of Ba ions in pure $Ba_xSr_{1-x}TiO_3$ strongly affects the ferroelectric-paraelectric phase transition temperature [1]. BST as a ferroelectric material has various technical advantages such as chemical stability, high permittivity, high dielectric constant, good thermal stability, and high tunability [2–7].

BST thin film is found in the perovskite family with general formula ABO_3 , which is the compositional modification in solid solution, substitution, and/or dopants. The addition of Ba atoms to the $SrTiO_3$ lattice substitutes the Sr atoms, influencing the crystalline structure and its properties⁶. Variation of BST mole fraction made is $SrTiO_3$, $Ba_{0.125}Sr_{0.875}TiO_3$, $Ba_{0.25}Sr_{0.75}TiO_3$, $Ba_{0.375}Sr_{0.625}TiO_3$, and $Ba_{0.5}Sr_{0.5}TiO_3$. Many techniques can be applied to

prepare BST thin film, one of that is chemical solution deposition [3,8–16]. BST data retrieval is done using an LCRmeter to get the impedance, capacitance, and conductance data of BST measured with 3 variations, in dark conditions (0 lux) and light conditions (4000 lux and 8000 lux).

2. Materials and Methods

In the substrate preparation, the p-type silicon (100) substrate was cut to form a rectangle with a size of 1 cm² then washed using double distilled water [11,12,17–20]. The materials used in the synthesis of BST with different Ba ratio (x = 0.000; 0.125; 0.250; 0.375; 0.500) were barium acetate [Ba(CH₃COO)₂, 99%], strontium acetate [Sr(CH₃COO)₂, 99%], titanium isopropoxide [Ti(C₁₂O₄H₂₈), 99.999%], The chemicals were calculated and weighed, corresponding to the stoichiometrical composition of Ba_xSr_{1-x}TiO₃. This material is dissolved with acetic acid [CH₃COOH, 100%] and ethylene glycol [C₂H₆O₂]. All of the materials are dissolved with a magnetic stirrer at a speed of 240 rpm. Thin-film BST was overgrown above the p-type silicon substrate with a spin coating technique at 8000 rpm for 30 seconds repeated 3 times. Then, BST films were annealed at 850 °C in the furnace model Vulcan™ with an increasing rate of 1.67 °C for 8 hours [14,20–28].

After that, a thin film is prepared to make an MFS layer. 2 holes in the BST part and 2 holes in the silicon substrate part will be made in contact, the remaining part will be covered with aluminum foil. Making contacts aims to install cables that can be used for characterization using LCR. Each cable is attached to each hole using silver paste [26,29,30].

3. Results and Discussion

The characterization was carried out under 3 different conditions, in the darkroom (0 lux), with lights 4000 lux and 8000 lux. Characterization using LCRmeter produces the value of conductance, capacitance, impedance, etc. The value of conductance can be used to calculate the electric conductivity. Electrical conductivity is represented by σ and is defined as the inverse of the resistivity as shown in equations 1, 2, 3 [12,15,28,31–37].

$$\sigma = \frac{1}{\rho} \quad (1)$$

$$\rho = \frac{RA}{l} \quad (2)$$

$$\frac{1}{R} = G \quad (3)$$

The value of conductance can be used to calculate electric conductivity by equation 4.

$$\sigma = \frac{Gl}{A} \quad (4)$$

where G is conductance obtained from the LCR meter.

The electric conductivity of Ba_xSr_{1-x}TiO₃ thin films under LCR characterization is shown in Figure 1.

Figure 1 shows that the electric conductivity tends to increase with increasing frequency. The various mole fraction produces various electric conductivity. Electric conductivity is also greater when it is given the greater intensity of light. This is due to the valence band to conduction band electrical conductivity increase. More electrons are excited into the conduction band due to irradiated light that causes the current to rise [10,20,32].

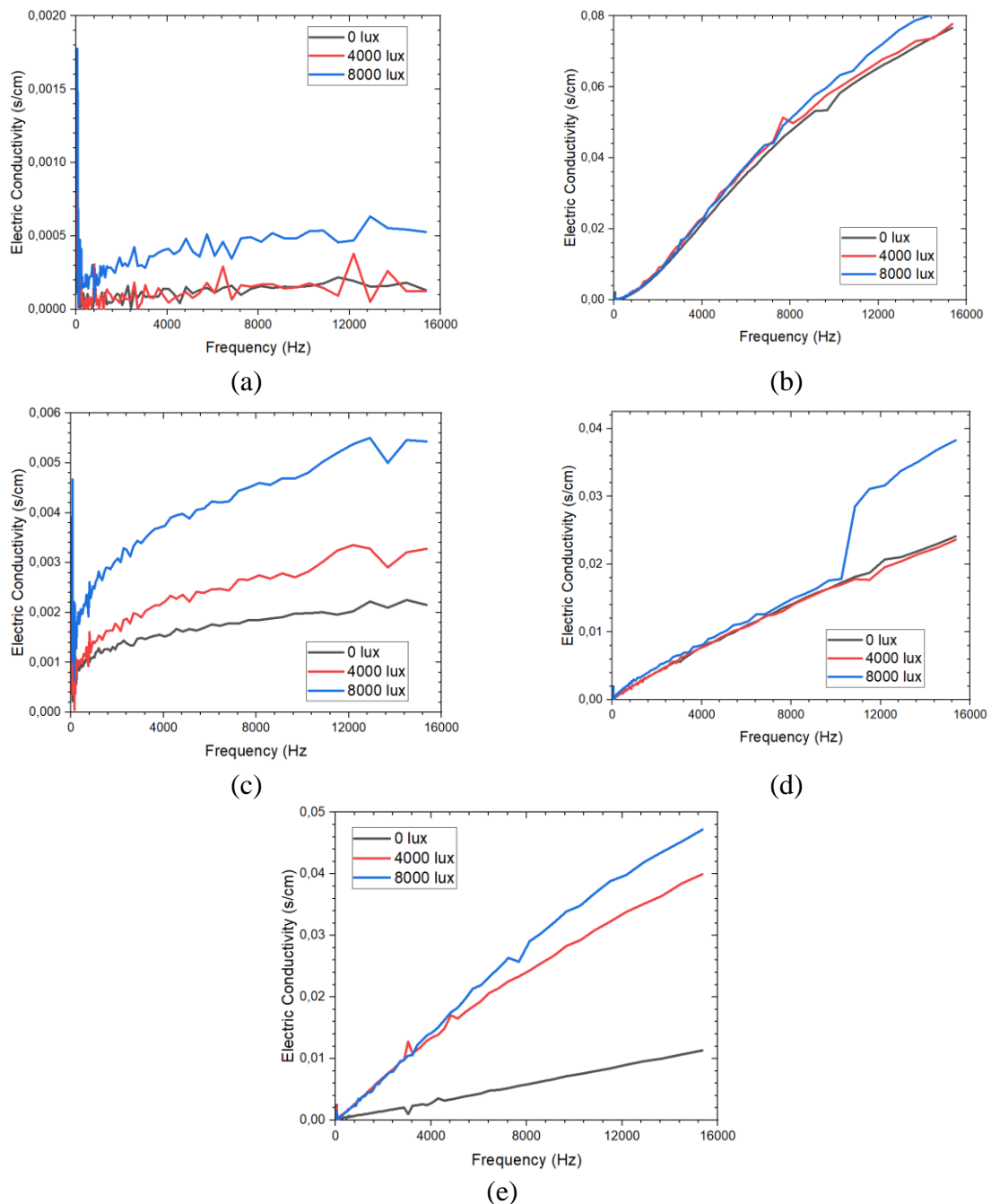


Figure 1/ Electric conductivity as a function of frequency for various mole fraction of BST: (a) $x = 0.000$; (b) $x = 0.125$; (c) $x = 0.250$; (d) $x = 0.375$; (e) $x = 0.500$.

Thus, the amount of light intensity indicates the energy given to films so that the light intensity will vary directly with electric conductivity.

The capacitance (C) was measured on the LCR meter used to get the dielectric constant (ϵ) that calculated using equation [1,12,37–40]:

$$\epsilon = \frac{cd}{\epsilon_0 A} \tag{5}$$

where ϵ_0 is the permittivity of free space 8.85×10^{-12} F/m), A is the electrodes' area, and d is the sample's thickness.

The graphs below show the relationship between the dielectric constant and the frequencies that tend to be inversely proportional. Variation of the mole fraction produces different dielectric constant graphs. The dielectric constant's value tends to go up from the mole fraction from 0 to 0.25 and down to the mole fraction from 0.375 to 0.5.

The dielectric constant of $Ba_xSr_{1-x}TiO_3$ thin films from LCR characterization is shown in Figure 2.

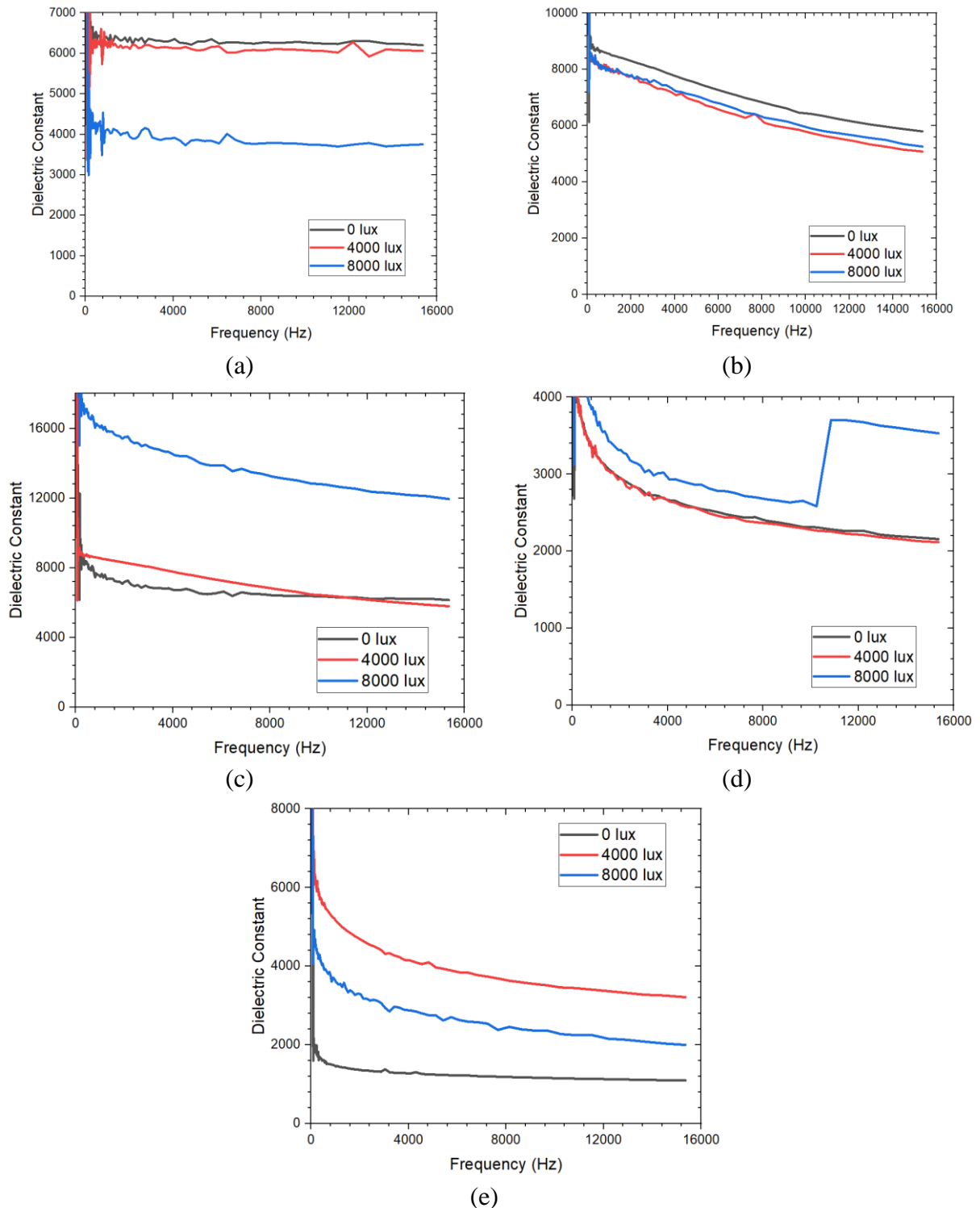


Figure 2. Dielectric constant as a function of frequency for various mole fraction of BST: (a) $x=0.000$; (b) $x=0.125$; (c) $x=0.250$; (d) $x=0.375$; (e) $x=0.500$.

The electric conductivity obtained from Eq. 4 can be used to calculate the diffusion coefficient by the equation below [12,32,41]:

$$D = k \frac{KT}{Cq^2} \sigma \tag{6}$$

σ is the electrical conductivity, C and q is the charge of the concentration and imperfections, k depends on the kinds of imperfections; $k = 1$ for the interstitial ion, k and T are the Boltzmann constant and temperature.

The diffusion coefficient of $Ba_xSr_{1-x}TiO_3$ thin films from LCR characterization is shown in Figure 3.

Figure 3 shows that the diffusion coefficient tends to increase with increasing frequency. That is because the diffusion coefficient depends on the electric conductivity value, which is directly proportional to the frequency, and that also causes this figure to have the same pattern as Figure 1.

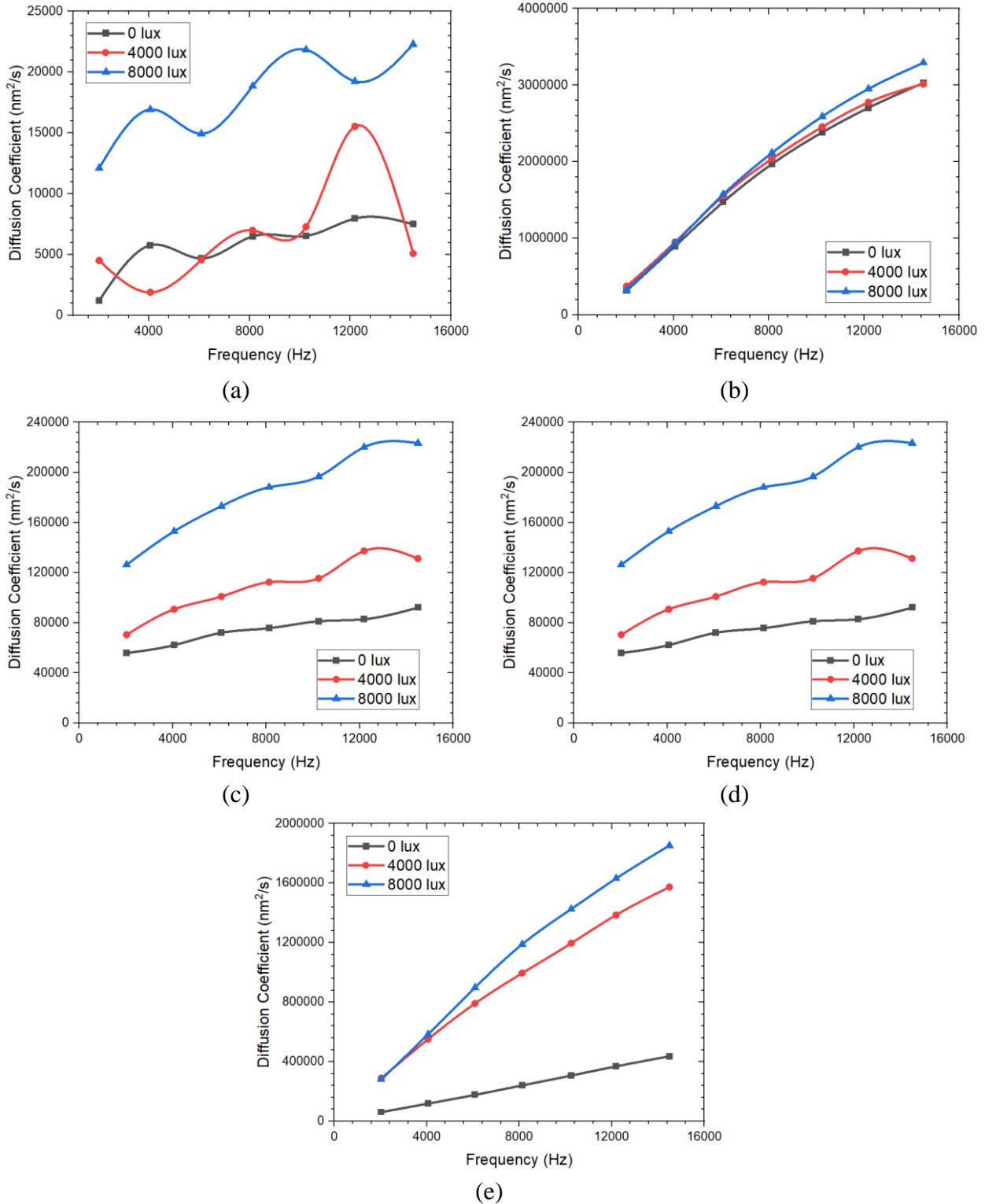


Figure 3. Diffusion coefficient as a function of frequency for various mole fraction of BST: (a) $x = 0.000$; (b) $x = 0.125$; (c) $x = 0.250$; (d) $x = 0.375$; (e) $x = 0.500$.

4. Conclusions

Has succeeded in making thin films based on thin film $Ba_xSr_{1-x}TiO_3$ ($x = 0.000; 0.125; 0.250; 0.375; 0.500$) with the effect of photoconductive mole fraction and its characterization on electrical properties and diffusivity coefficient.

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Conflicts of Interest

The authors declare no conflict of interest. The funders had no role in the study's design, in the collection, analyses, or interpretation of data, in the writing of the manuscript, or in the decision to publish the results.

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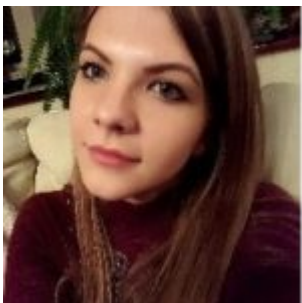


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 (<https://www.scopus.com/authid/detail.uri?authorId=57094267500>)

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Department of Chemistry, University of Johannesburg, Johannesburg, South Africa

 (<https://www.scopus.com/authid/detail.uri?authorId=24765141500>)

Research interests: Nano sensor and bio electrochemistry; Surface chemistry and electrochemical sensors; Conductive polymers in electrochemistry; Modified electrodes in electrochemistry; Environmental chemistry; Drug and food Analysis; Synthesis of nanomaterials such as nanoparticles and nanocomposite; Analysis of food compounds; DNA interaction with drug and environmental compounds; Nanobiotechnology; Drug delivery; Removal of pollutants with using nanomaterials.



Zhi-Yao He ,  (<https://orcid.org/0000-0001-7888-211X>)

West China Hospital, Sichuan University, Chengdu, Sichuan, China

 (<https://www.scopus.com/authid/detail.uri?authorId=36025183400>)

Research interests: develop and improve gene delivery strategies or gene therapy methods for diseases, especially for cancer.

Editorial Board



Hu Li ,  (<https://orcid.org/0000-0003-3604-9271>)

College of Engineering, Nanjing Agricultural University, China

 (<https://www.scopus.com/authid/detail.uri?authorId=35933455300>)

Research interests: Biomass conversion; Bioenergy & Biofuels; Biorefinery; Sustainable/Green chemistry; Heterogeneous catalysis; Functional catalytic materials; Reaction mechanism; Organic synthesis

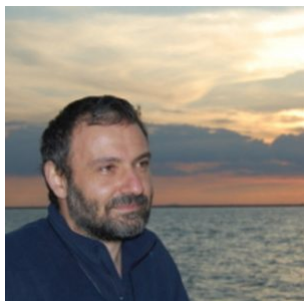
Howard I. Maibach , 



Department of Dermatology, 90 Medical Center Way, Surge Building Room 110, University of California, San Francisco, USA

Scopus (<https://www.scopus.com/authid/detail.uri?authorId=36066921500>)

Research interests: allergic skin disorders and skin conditions caused by exposure to toxic substances



Dan Eduard Mihaiescu  (<http://orcid.org/0000-0001-9873-3912>), 

(https://scholar.google.com/citations?user=DH6-2_wAAAAJ&hl=en)

Politehnica University of Bucharest, Faculty of Applied Chemistry and Material Science, Romania

Scopus (<https://www.scopus.com/authid/detail.uri?authorId=6602674733>)

Research interests: thin coatings, laser ablation, nanomaterials, drug

delivery;

Veronica Lazar ,  (<https://scholar.google.com/citations?user=YIZAZF8AAAAJ&hl=en>)

University of Bucharest, Faculty of Biology, Microbiology Department, Romania

Scopus (<https://www.scopus.com/authid/detail.uri?authorId=16310319700>)

Research interests: applied microbiology; Immunology; Virology;

Mariana Chirea ,  (<http://orcid.org/0000-0001-6881-9432>),

Departamento de Química Física, Universidade de Vigo, 36310 Vigo, Pontevedra, Spain

Scopus (<https://www.scopus.com/authid/detail.uri?authorId=9940726100>)

Research interests: electron transfer kinetics at films composed of spherical nanomaterials and polymers, thiol and nanorods, thiol and nanostars, or films of nanodendrites for applications in electrochemical sensing, fuel cells or energy storage devices.

Evghenia Bezirtzoglou , 

Democritus University of Thrace Faculty of Agricultural Development, Department of Food Science and Technology, Greece

Scopus (<https://www.scopus.com/authid/detail.uri?authorId=7003748111>)

Research interests: microbial ecology, gastrointestinal microflora, food, and environmental microbiology.

Keng-Shiang Huang  

The School of Chinese Medicine for Post-Baccalaureate, I-Shou University,
Ta-Hsu Hsiang, Taiwan

Scopus [\(https://www.scopus.com/authid/detail.uri?authorId=7403187825\)](https://www.scopus.com/authid/detail.uri?authorId=7403187825)

Research interests: microfluidic controlling; microdroplet; microfluidic chip
fabrication; antimicrobial polymers; pulsatile delivery;

Carmen Limban  

University of Medicine and Pharmacy Carol Davila, Faculty of Pharmacy,
Romania

Scopus [\(https://www.scopus.com/authid/detail.uri?authorId=15072175400\)](https://www.scopus.com/authid/detail.uri?authorId=15072175400)

Research interests: Medicinal and Pharmaceutical Chemistry; Materials
Chemistry; Antimicrobials; Natural Product Chemistry; Heterocyclic
Chemistry; Organic Chemistry; Chemical Synthesis; IR; Pharmaceutical Chemistry;

Anton Fikai  [\(http://orcid.org/0000-0002-1777-0525\)](http://orcid.org/0000-0002-1777-0525), 

[\(https://scholar.google.com/citations?user=wSWLTkQAAAAJ&hl=en\)](https://scholar.google.com/citations?user=wSWLTkQAAAAJ&hl=en)

Faculty of Applied Chemistry and Materials Science, Politehnica University
of Bucharest, Romania

Scopus [\(https://www.scopus.com/authid/detail.uri?authorId=55879554500\)](https://www.scopus.com/authid/detail.uri?authorId=55879554500)

Research interests: tissue engineering; drug delivery systems;
multifunctional materials; composite materials; antimicrobial/antitumoral materials; nanoparticles
synthesis and characterization; surface modification;

Victoria Samanidou  [\(http://orcid.org/0000-0002-8493-1106\)](http://orcid.org/0000-0002-8493-1106), 

[\(https://scholar.google.com/citations?user=kovUyLoAAAAJ&hl=en\)](https://scholar.google.com/citations?user=kovUyLoAAAAJ&hl=en)

Department of Chemistry, School of Sciences, Aristotle University of
Thessaloniki, Greece

Scopus [\(https://www.scopus.com/authid/detail.uri?authorId=7003896015\)](https://www.scopus.com/authid/detail.uri?authorId=7003896015)

Research interests: Method development and validation by HPLC, GC, IC,
with applications in the analysis of organic substances in forensics, toxicology, food, biological,
pharmaceutical, and samples of environmental interest using various modern sample preparation
techniques.

Vladimir K. Ivanov   [\(https://scholar.google.com/citations?user=-cDZrLYAAAAJ&hl=en\)](https://scholar.google.com/citations?user=-cDZrLYAAAAJ&hl=en)

Kurnakov Institute of General and Inorganic Chemistry of the Russian Academy of Sciences, Moscow, Russia

Scopus [\(https://www.scopus.com/authid/detail.uri?authorId=56532555100\)](https://www.scopus.com/authid/detail.uri?authorId=56532555100)

Research interests: Material Characterization; Nanomaterials Synthesis; X-ray Diffraction; Materials; Nanomaterials; Material Characteristics; Advanced Materials; Materials Processing; Synthesis.

Santiago D. Palma  [\(http://orcid.org/0000-0003-2767-9087\)](http://orcid.org/0000-0003-2767-9087),  [\(https://scholar.google.com.ar/citations?user=Wj9YPxAAAAAJ&hl=en\)](https://scholar.google.com.ar/citations?user=Wj9YPxAAAAAJ&hl=en)

Department of Pharmacy, Faculty of Chemical Sciences, National University of Córdoba, Córdoba, Argentina

Scopus [\(https://www.scopus.com/authid/detail.uri?authorId=7003268225\)](https://www.scopus.com/authid/detail.uri?authorId=7003268225)

Research interests:

Jose Luis Balcazar  [\(http://orcid.org/0000-0002-6866-9347\)](http://orcid.org/0000-0002-6866-9347),  [\(https://scholar.google.com/citations?user=yA6vW3wAAAAJ&hl=en\)](https://scholar.google.com/citations?user=yA6vW3wAAAAJ&hl=en)

Catalan Institute for Water Research, Girona, Spain

Scopus [\(https://www.scopus.com/authid/detail.uri?authorId=35606765900\)](https://www.scopus.com/authid/detail.uri?authorId=35606765900)

Research interests: host-microbe interactions, microbial diversity, and antibiotic resistance in the environment.

George D. Mogosanu  [\(http://orcid.org/0000-0001-6338-9277\)](http://orcid.org/0000-0001-6338-9277),  [\(https://scholar.google.com/citations?user=K1w2TfoAAAAJ&hl=en\)](https://scholar.google.com/citations?user=K1w2TfoAAAAJ&hl=en)

Department of Pharmacognosy & Phytotherapy, Faculty of Pharmacy, University of Medicine and Pharmacy of Craiova, Romania

Scopus [\(https://www.scopus.com/authid/detail.uri?authorId=33068128700\)](https://www.scopus.com/authid/detail.uri?authorId=33068128700)

Research interests: phytochemicals, isolation, and characterization.

Mihaela Badea   [\(https://scholar.google.com/citations?user=1PF_4hsAAAAJ&hl=en\)](https://scholar.google.com/citations?user=1PF_4hsAAAAJ&hl=en)

University of Bucharest, Faculty of Chemistry, Romania

Scopus [\(https://www.scopus.com/authid/detail.uri?authorId=7003682477\)](https://www.scopus.com/authid/detail.uri?authorId=7003682477)

Research interests: coordination chemistry, inorganic synthesis, materials chemistry, thermal analysis.

Department of Mechanical Engineering, Bu-Ali Sina University, Hamedan, Iran

 (<https://www.scopus.com/authid/detail.uri?authorId=57189276752>)



Research interests: Heat and Mass Transfer, Thermodynamics, Exergy and Second Law Analysis, Computational Fluid Dynamics (CFD), Nonlinear Analysis, Engineering Mathematics, Numerical and Experimental Investigations of Nanofluids Flow for Increasing Heat Transfer, Study of Magnetohydrodynamic Viscous Flow and Study of Magnetic Beads Motion (Creeping Flow Regime).

Mazeyar P. Gashti  (<http://orcid.org/0000-0001-6584-4827>), 

PRE Labs Inc., Kelowna, Canada

 (<https://www.scopus.com/authid/detail.uri?authorId=25027474600>)

Research interests: Microfluidic devices for tissue and fiber production, Synthesis of composites in gels, Smart fibers, Nanocomposite Coatings with novel methods

Mu. Naushad  (<http://orcid.org/0000-0001-6056-587X>), 
(https://scholar.google.com/citations?user=E4MN_HoAAAAJ&hl=en)

Department of Chemistry, College of Science, King Saud University, Riyadh, Saudi Arabia

 (<https://www.scopus.com/authid/detail.uri?authorId=13105221300>)

Research interests: Analytical Chemistry, Materials Chemistry and Environmental Science

Rabah Khenata  ,  (<https://scholar.google.com/citations?user=4FYHetYAAAAJ&hl=en>)

Faculty of Sciences & Technology, Mascara University, Algeria

 (<https://www.scopus.com/authid/detail.uri?authorId=6508291264>)

Research interests: structural, mechanical, magnetic and optoelectronic properties of crystalline materials using Density functional theory (DFT) as implemented in some computer packages.

Zivile Luksiene  ,  (<https://scholar.google.lt/citations?user=Hu2bcNQAAAAJ&hl=en>)

Vilnius University, Inst. Applied Research, Sauletekio 10, 10223, Vilnius, Lithuania

 (<https://www.scopus.com/authid/detail.uri?authorId=55909649500>)

Research interests: Application of light in life sciences; Biomedical optics: fundamental, applications, clinical investigation; Food safety and quality: development of novel non-thermal antimicrobial technologies; Biophotonic technologies for organic agriculture and food safety and quality; inactivation of pathogenic and harmful microorganisms

He Yong  (<http://orcid.org/0000-0001-6752-1757>), 

College of Biosystems Engineering & Food Science, Zhejiang University, China

 (<https://www.scopus.com/authid/detail.uri?authorId=36079131500>)

Research interests:

Alina Maria Holban ,  (<https://scholar.google.com/citations?user=1Px1JYAAAAAJ&hl=en>)

Faculty of Biology, University of Bucharest, Romania

 (<https://www.scopus.com/authid/detail.uri?authorId=55630243600>)

Research interests: antimicrobial therapy; nanostructured drugs; biofilms; host-pathogen interactions;

Florin Iordache ,  (<https://scholar.google.com/citations?user=VHgRPdIAAAAJ&hl=en>)

Institute of Cellular Biology and Pathology "Nicolae Simionescu" (ICBP), Bucharest, Romania

 (<https://www.scopus.com/authid/detail.uri?authorId=56442793100>)

Research interests: Molecular biology, cell culture, cell biology.

Valentina Grumezescu , 

Lasers Department, National Institute for Lasers, Plasma and Radiation Physics, Romania

 (<https://www.scopus.com/authid/detail.uri?authorId=55209888700>)

Research interests: thin coatings; modulation of microbial biofilm; drug targeting; hard tissue engineering;

Eliana M. Barbosa Souto ,  (<http://orcid.org/0000-0002-9737-6017>), 

Faculdade de Farmácia da Universidade de Coimbra, Portugal

 (<https://www.scopus.com/authid/detail.uri?authorId=8839435500>)

Research interests: design, development, and characterization of new drug delivery systems. Other research interests include the controlled delivery of drugs across biological barriers, e.g. skin, gastrointestinal tract and blood-brain-barrier.

A.A. Pantazaki  

Dept. of Chemistry, Aristotle University of Thessaloniki, 54124 Thessaloniki, Greece

 (<https://www.scopus.com/authid/detail.uri?authorId=6601911470>)

Research interests:

Tin Wui Wong  (<http://orcid.org/0000-0002-9131-6937>), 

(<https://scholar.google.com/citations?user=a5XrVwwAAAAJ&hl=en>)

Non-Destructive Biomedical and Pharmaceutical Research Centre, iPROMISE, Universiti Teknologi, MARA, Malaysia

 (<https://www.scopus.com/authid/detail.uri?authorId=7403531742>)

Research interests: Oral/transdermal drug delivery; Particle design; Polymeric drug delivery system; Wound dressing; Pharmaceutical analysis; Pharmaceutical processor design.

Paul Balaure   (https://scholar.google.com/citations?user=5_ds1rcAAAAJ&hl=en)

Faculty of Applied Chemistry and Materials Science, University Politehnica of Bucharest, Romania

 (<https://www.scopus.com/authid/detail.uri?authorId=6507593592>)

Research interests: antimicrobials, nanomaterials, organic synthesis, drug targeting and delivery.

Marcello Iriti  (<https://orcid.org/0000-0002-5063-1236>), 

Department of Agricultural and Environmental Sciences, Faculty of Agricultural and Food Sciences, Milan State University, Italy

 (<http://www.scopus.com/inward/authorDetails.url?authorID=6506548774&partnerID=MN8TOARS>)

Research interests: Bioactive phytochemicals, foods and medicinal plants.

Nima Rezaei  (<http://orcid.org/0000-0002-3836-1827>),  (<https://scholar.google.com/citations?user=aqiMhRgAAAAJ&hl=en>)

Children's Medical Center Hospital, Dr. Qarib St, Keshavarz Blvd, Iran

 (<https://www.scopus.com/authid/detail.uri?authorId=57204849465>)

Research interests: Paediatric Immunology and Infectious Diseases; genetics & heredity; immunology; primary immunodeficiency disorders; Cancer Immunology;

Hazizan bin Md Akil ,  (<https://scholar.google.co.uk/citations?user=jCZhon8AAAAJ&hl=en>)

School of Materials and Mineral Resources Engineering, Engineering Campus, Universiti Sains Malaysia, Malaysia

 (<https://www.scopus.com/authid/detail.uri?authorId=7102836574>)

Research Interests: Polymer Composites, 3D printing of polymers and Hydrogels

Elias C. Aifantis , 

Aristotle University of Thessaloniki, Greece / Mechanics and Optics University ITMO, Saint Petersburg, Russian Federation

 (<https://www.scopus.com/authid/detail.uri?authorId=34871245600>)

Research interests: dislocation patterning and material instabilities, gradient elasticity and plasticity, chemomechanics and nanomechanics.

Kailas L. Wasewar ,  (<https://scholar.google.com/citations?user=GCbHFnEAAAAJ&hl=en>)

Department of Chemical Engineering, Visvesvaraya National Institute of Technology (VNIT), India

 (<https://www.scopus.com/authid/detail.uri?authorId=6506156879>)

Research interests: Biotechnology, Reaction Engineering, Process Intensification, Separation Technology, Environmental Engineering, Ionic Liquids, Nanotechnology, CFD, Modeling & Simulation, and Reliability Engineering;

Javed Ali ,  (<http://orcid.org/0000-0001-5308-0655>),  (<https://scholar.google.co.in/citations?user=ivR2PTUAAAAJ&hl=en&authuser=1>)

Department of Pharmaceutics, Faculty of Pharmacy, Jamia Hamdard, Hamdard Nagar, India

 (<https://www.scopus.com/authid/detail.uri?authorId=25641028400>)

Research interests: Improving oral bioavailability of BCS class II and Class IV drugs using polymeric conjugates and lipid based systems like microemulsions, nanoemulsions, solid lipid nanoparticles and nanostructured lipid carriers

Iola Melissa Fernandes Duarte  (<http://orcid.org/0000-0003-4289-9256>) 
(<https://scholar.google.com/citations?user=Q4kjkRcAAAAJ&hl=en>)

CICECO – Aveiro Institute of Materials, Department of Chemistry, University of Aveiro, Portugal

 (<https://www.scopus.com/authid/detail.uri?authorId=7007025414>)



Research interests: immune metabolic deregulations in chronic inflammatory diseases; tumour metabolism, anticancer drugs and nanomedicines, biological responses to nanomaterials.

Mustafa Turkyilmazoglu  (<https://orcid.org/0000-0003-0412-4580>), 
(https://scholar.google.com.tr/citations?user=F_6HfxsAAAAJ&hl=tr)

Department of Mathematics, University of Hacettepe, Turkey

 (<https://www.scopus.com/authid/detail.uri?authorId=6603562364>)

Research interests: Fluid mechanics, Hydrodynamic stability theory, Rotating-disk flow, High-Reynolds number flows, Triple-deck asymptotic theory of compressible viscous flows, Numerical simulation.

Sibel A. Ozkan  (<http://orcid.org/0000-0002-9547-7375>), 
(<https://scholar.google.com/citations?user=Ti6eQcUAAAAJ&hl=en>)

Ankara University, Faculty of Pharmacy, Department of Analytical Chemistry, Tandogan, Turkey

 (<https://www.scopus.com/authid/detail.uri?authorId=7102661492>)

Research interest: analysis of pharmaceuticals with using separation techniques especially on liquid chromatography, method development and their validation, electroanalytical techniques, novel electrode materials, nano-structured materials, surface-modified electrodes, fabrication of biosensors and nano-sensors, analysis of pharmaceuticals from their dosage forms and biological samples.

Cristobal Noe Aguilar Gonzalez  (<http://orcid.org/0000-0001-5867-8672>), 
(<https://scholar.google.com/citations?user=YiRXQjIAAAAAJ&hl=en>)

Department of Food Research (DIA-UAdeC), School of Chemistry, University Autonomous of Coahuila, Mexico

 (<https://www.scopus.com/authid/detail.uri?authorId=7102461199>)


Research interest: Tannase; Bioactive Extraction; Active Peptides; Active Oligosaccharides; Candelilla Wax; Tannins-Gallic acid-Ellagic acid; Solid-State Fermentation; Edible Films and Coatings; Bioactives and Bioactivities; Biocontrol

Rajeshwar Sinha ,  (<https://scholar.google.com/citations?user=3xcuJzAAAAJ&hl=en>)

Laboratory of Photobiology and Molecular Microbiology, Centre of Advanced Study in Botany, Banaras Hindu University, India

 (<https://www.scopus.com/authid/detail.uri?authorId=35485458700>)

Research interest: UV radiation effects on aquatic ecosystems (DNA damage and repair, phycobiliproteins, mycosporine-like amino acids and scytonemin)

Hassan Vatandoost ,  (https://scholar.google.com/citations?hl=en&user=krRd7M8AAAAJ&view_op=list_works&sortby=pubdate)

Department of Environmental Chemical Pollutants and Pesticides, National Institute for Environmental Research, School of Public Health, Tehran University of Medical Sciences, Iran

 (<https://www.scopus.com/authid/detail.uri?authorId=9743822200>)

Research interest: Study on the identification of mosquitoes using molecular genetics; Investigation on the mechanisms involved in insecticide resistance in arthropods; Study on the functional basis of insecticide resistance on malaria vectors; Using of biological control agents including *Lagenidium giganteum*, *Bacillus thuringiensis* for malaria vectors.

Jia-Qian Jiang ,  (<http://orcid.org/0000-0003-3607-8910>),  (https://scholar.google.com/citations?user=Zyed_sQAAAAJ&hl=en)

School of Engineering and Built Environment, Glasgow Caledonian University, Glasgow G4 0BA, Scotland, United Kingdom

 (<https://www.scopus.com/authid/detail.uri?authorId=22979801300>)

Research interest: advanced water and wastewater treatment technologies and processes; pollution remediation;

Sanjay K. Jain , 

Pharmaceutics Research Projects Laboratory, Department of Pharmaceutical Sciences, Dr. H. S. Gour Central University, India

Scopus [\(https://www.scopus.com/authid/detail.uri?authorId=57207930125\)](https://www.scopus.com/authid/detail.uri?authorId=57207930125)

Research interest: Controlled Release, Nanoparticles, Formulations, Controlled Drug Delivery, Nanotechnology in Drug Delivery, Pharmaceuticals and Pharmaceutical Technology, Biomaterials, Liposomes, Nano Drug Delivery

Gaurav Sharma  [\(http://orcid.org/0000-0002-5010-1710\)](http://orcid.org/0000-0002-5010-1710), 

School of Chemistry, Shoolini University, India

Scopus [\(https://www.scopus.com/authid/detail.uri?authorId=57200185826\)](https://www.scopus.com/authid/detail.uri?authorId=57200185826)

Research interest: Nanocomposites, Bimetallic & trimetallic nanoparticles, Green Chemistry, Photocatalysis, Ion exchanger and Environmental remediation

Wei (Willy) Chu  [\(http://orcid.org/0000-0002-7166-5443\)](http://orcid.org/0000-0002-7166-5443), 

School of Chemical Engineering, Sichuan University, China

Scopus [\(https://www.scopus.com/authid/detail.uri?authorId=55760847300\)](https://www.scopus.com/authid/detail.uri?authorId=55760847300)

Research interest: Energy Catalysis and Chemical Engineering, Nano Functional Materials, Petrochemicals, Carbon management (CCUS) , Environmental Engineering, Polymer & Chemical Sciences; Fischer Tropsch Synthesis, Clean Energy (Hydrogen, etc), Li Battery, Supercapacitor, CNT, GN, Plasma

Luis R. Pizzio ,  [\(https://scholar.google.es/citations?user=JRVe4hkAAAAJ&hl=en\)](https://scholar.google.es/citations?user=JRVe4hkAAAAJ&hl=en)

Centro de Investigación y Desarrollo en Ciencias Aplicadas Dr. Jorge J. Ronco (CINDECA), Departamento de Química, Facultad de Ciencias Exactas, Argentina

Scopus [\(https://www.scopus.com/authid/detail.uri?authorId=6701327888\)](https://www.scopus.com/authid/detail.uri?authorId=6701327888)

Research interest: thin films and nanotechnology, mesoporous materials, catalyst design.

Lala Behari Sukla  [\(http://orcid.org/0000-0001-5684-3021\)](http://orcid.org/0000-0001-5684-3021),  [\(https://scholar.google.com/citations?user=SaflpMUAAAAJ&hl=en\)](https://scholar.google.com/citations?user=SaflpMUAAAAJ&hl=en)

Biofuels and Bioprocessing Research Center, Siksha 'O' Anusandhan University, Khandagiri Square, Near PNB, India

Scopus [\(https://www.scopus.com/authid/detail.uri?authorId=6603724593\)](https://www.scopus.com/authid/detail.uri?authorId=6603724593)

Research interest: Biodiesel from Microalgae, Biomineral processing for extraction of metal values from ores, concentrates and wastes. Bioleaching, Biobenefication, Bioadsorption, Bioprecipitation, Bioremediation, Microbial strain improvement.

Hermann Ehrlich   (<https://scholar.google.de/citations?user=aDJja38AAAAJ&hl=en>)

Institute of Electronics and Sensor Materials, TU Bergakademie Freiberg, Germany.

 (<https://www.scopus.com/authid/detail.uri?authorId=55722706100>)

Research interest: marine biomaterials, biominerals, biocomposites and biomimetics.

Li Zhou  (<http://orcid.org/0000-0003-0650-5256>), 

Key Laboratory of New Processing Technology for Nonferrous Metal & Materials (Ministry of Education), and College of Materials Science and Engineering, Guilin University of Technology, Guilin 541004, P. R. China

 (<https://www.scopus.com/authid/detail.uri?authorId=57164679600>)

Research interest: Surface modification of functional inorganic nanomaterials for various applications; natural polysaccharide for bio-applications; magnetic and fluorescent nanomaterials; hyperbranched polymers.

Khan Moonis  (<https://orcid.org/0000-0002-0548-8581>), 
(https://scholar.google.co.in/citations?user=SwW_98MAAAAJ&hl=en)

Department of Chemistry, College of Science, King Saud University, Saudi Arabia

 (<https://www.scopus.com/authid/detail.uri?authorId=51261077500>)

Research interest: analytical chemist; interfacial chemistry.

Miao Ming  

State Key Laboratory of Food Science and Technology, Jiangnan University, China

 (<https://www.scopus.com/authid/detail.uri?authorId=36840373200>)

Research interest: Food Chemistry, Food Processing and Engineering, Food and Nutrition, Food Safety, Food Technology, Enzymes.

Cacciotti Iliaria  (<http://orcid.org/0000-0002-3478-6510>), 
(<https://scholar.google.com/citations?user=6fRqQuAAAAJ&hl=en>)

Niccolò Cusano University, Rome, Italy

 (<https://www.scopus.com/authid/detail.uri?authorId=16201946300>)

Research interest: Synthesis and characterization of biomaterials; Bone tissue engineering; Biomaterials for tissue engineering;

Ivo Grabchev  (<http://orcid.org/0000-0001-7204-8183>), 

(<https://scholar.google.com/citations?user=MUNSn7kAAAAJ&hl=en>)

Department "Chemistry and Biochemistry, Physiology and Pathophysiology", Faculty of Medicine, University of Sofia "St. Kliment Ohridski", Sofia, Bulgaria

 (<https://www.scopus.com/authid/detail.uri?authorId=7004847951>)

Research interest: Dye chemistry, dendrimers, fluorescent polymers, fluorescence, PET sensors, artificial antenna systems, biological systems

Tadeusz Hryniewicz ,  (<http://orcid.org/0000-0002-6425-7273>)

Department of Engineering and Informatics Systems, Koszalin University of Technology, Poland

 (<https://www.scopus.com/authid/detail.uri?authorId=6604026438>)



Research interests: Machine technology, Surface technology, Surface electrochemistry studies, Hydrogen embrittlement cases, Electrochemical corrosion studies, Plasma Electrolytic Oxidation.

Kostoglou Margaritis ,  (<https://scholar.google.gr/citations?user=11LN7KEAAAAJ&hl=en>)

Department of Chemistry, Aristotle University of Thessaloniki, Greece

 (<https://www.scopus.com/authid/detail.uri?authorId=55163355200>)

Research interests: Transport phenomena, Unit processes, Physicochemical Engineering, Mathematical modeling, Interfaces Science, Controlled Release modeling.

Ling Wen Ding ,  (<https://orcid.org/0000-0003-0022-1551>), (<http://scholar.google.com.sg/citations?user=ZY7-kcoAAAAJ&hl=en>)

Cancer Science Institute of Singapore, NUS, Singapore

 (<https://www.scopus.com/authid/detail.uri?authorId=57202281673>)

Research interests: Immunotherapy and targeted therapy of cancer, cancer vaccine, cancer genome and cfDNA based cancer screening.

Minhaz Uddin Ahmed  (<https://orcid.org/0000-0002-8267-8506>), 

University Brunei Darussalam, Bandar Seri Begawan, Brunei Darussalam

Scopus  (<https://www.scopus.com/authid/detail.uri?authorId=7402830936>)

Research interests: analytical and bioanalytical chemistry, chemistry of nanomaterials, biosensors, next generation nucleic acids and protein biosensors, novel chemical biology and biomaterials approaches, point-of-care micro devices, agro/food based applied biotechnology

Martin Koller  (<https://orcid.org/0000-0002-9251-1822>), 

Institute of Chemistry, University of Graz, Austria

Scopus  (<https://www.scopus.com/authid/detail.uri?authorId=8275612000>)

Research interests: Conversion of surplus materials of (agro)industrial origin towards value-added bio-products (polyhydroxyalkanoates); Optimization of biopolyesters production regarding economics, productivity and product quality (material performance) (polyhydroxyalkanoates); Downstream processing for efficient and sustainable recovery of intracellular bio-products (polyhydroxyalkanoates)

George Aggelis  (<https://orcid.org/0000-0002-1200-5592>), 

Unit of Microbiology, Division of Genetics, Cell and Developmental Biology, Department of Biology, University of Patras, Greece

Scopus  (<https://www.scopus.com/authid/detail.uri?authorId=7003394202>)

Research interests: Microbial Biotechnology; single cell oil; microbial (yeast, fungal, algal) lipid biosynthesis and biotechnology; polyunsaturated fatty acids; organic acids; degradation of phenolics; Microbial metabolism of glycerol, methanol, fatty acids; modelling.

Heinz Hendrik  

Department of Chemical and Biological Engineering, University of Colorado-Boulder, United States

Scopus  (<https://www.scopus.com/authid/detail.uri?authorId=7006495491>)

Research interests: Computer simulation of inorganic-(bio)organic interfaces and biomineralization; Design of catalysts and functional materials; Development of force fields for the prediction of multiphase material properties; Hierarchical simulation of building materials and multiscale mechanics; Structure-property relationships in polymer nanocomposites.

Guardia Pablo  [ID \(https://orcid.org/0000-0001-9076-4642\)](https://orcid.org/0000-0001-9076-4642), 

Catalonia Institute for Energy Research – IREC, Spain

Scopus [ID \(https://www.scopus.com/authid/detail.uri?authorId=16506603700\)](https://www.scopus.com/authid/detail.uri?authorId=16506603700)

Research interests: Biosensors; Nanoparticles; Chemical physics of materials; Autoassembly;

Nanostructures; Optic materials; Semiconductors; Nanomaterials;

Magnetics; Nanobiotechnology; Mini and micro robots

Baoyang Lu  [ID \(https://orcid.org/0000-0003-4663-4706\)](https://orcid.org/0000-0003-4663-4706), 

School of Pharmacy, Jiangxi Science & Technology Normal University, China | Massachusetts Institute of Technology, Cambridge, USA

Scopus [ID \(https://www.scopus.com/authid/detail.uri?authorId=24822324300\)](https://www.scopus.com/authid/detail.uri?authorId=24822324300)

Research interests: Design and synthesis of novel conjugated polymer-based molecular systems, and fabrication of organic optoelectronic devices; Conducting polymer hydrogels and their applications.

Morata Antonio  [ID \(https://orcid.org/0000-0003-1275-6721\)](https://orcid.org/0000-0003-1275-6721), 

Universidad Politécnica de Madrid, Madrid, Spain

Scopus [ID \(https://www.scopus.com/authid/detail.uri?authorId=8353219900\)](https://www.scopus.com/authid/detail.uri?authorId=8353219900)

Research interests: wine technology and microbiology, anthocyanins and stable pyranoanthocyanins, emerging technologies of food processing and preservation.

Eirini Marouli  

William Harvey Research Institute, Barts and The London School of Medicine and Dentistry, Queen Mary University of London, United Kingdom

Scopus [ID \(https://www.scopus.com/authid/detail.uri?authorId=57204885457\)](https://www.scopus.com/authid/detail.uri?authorId=57204885457)

Research interests: Computational Biology, Genetics, disease prediction.

Harinder Singh Oberoi  (<http://orcid.org/0000-0001-8851-103X>), 

Division of Post Harvest Technology and Agricultural Engineering, ICAR – Indian Institute of Horticultural Research, Bengaluru, India

Scopus (<https://www.scopus.com/authid/detail.uri?authorId=6603479987>)

Research interests: Fermentation, Food processing and safety, Bioprocessing and Biovalorization

Mohammad A. Al-Ghouti ,  (<https://scholar.google.com/citations?user=TH7TGJ4AAAAJ>)

Department of Biological and Environmental Sciences, College of Arts and Sciences, Qatar University, Qatar

Scopus (<https://www.scopus.com/authid/detail.uri?authorId=23048725500>)

Research interests: prepare and modify surface of adsorbents, polymers, and membranes, study the adsorption mechanisms and the influence on the chemical and physical characteristics on the remediation behavior on various environmental compartments, including areas of: environmental chemistry, membrane coating and technology, polymer and membrane modification.

Ilias Giannenas , 

Faculty of Veterinary Medicine, Aristotle University of Thessaloniki, University Campus, 54124, Thessaloniki, Greece

Scopus (<https://www.scopus.com/authid/detail.uri?origin=resultslist&authorId=6603458827>)

Research interests: Aromatic plants in feeding of poultry as alternative growth promoters, alternative coccidiostats and antioxidants; Natural substances such as probiotics, prebiotics, organic acids, enzymes and trace elements in poultry nutrition; Aromatic plants in feeding of ruminants as alternative growth promoters and antioxidants.

Mohamed Bououdina ,  (<https://scholar.google.com/citations?user=nVQSU8AAAAJ&hl=en>)

University of Bahrain, Sakhir, Bahrain

Scopus (<https://www.scopus.com/authid/detail.uri?authorId=7004156513>)

Research interest: biosynthesis & nanotoxicology.

Hani Nasser Abdelhamid  (<http://orcid.org/0000-0002-3106-8302>),  (https://scholar.google.com/citations?user=y_Fr2cYAAAAJ&hl=en)

Department of Chemistry, Assiut University, Egypt

 (<http://www.scopus.com/authid/detail.url?authorId=55370888300>)

Research interest: Nanotechnology: synthesis, characterization, and applications; Material Chemistry, synthesis, characterization, and applications; Metal-Organic Frameworks (MOFs), synthesis, characterization, and applications; Inorganic and structural chemistry.

Esra Capanoglu Guven  (<https://orcid.org/0000-0003-0335-9433>), 

Food Engineering Department, Faculty of Chemical & Metallurgical Engineering, Istanbul Technical University (ITU), Turkey

 (<https://www.scopus.com/authid/detail.uri?authorId=23666338900>)

Research interest: Food Chemistry, Fruit and Vegetable Processing, Plant Biochemistry, Antioxidants, Phenolics, In vitro Bioaccessibility, Functional Foods, Sensory Analysis Food/Plant Analyses: LC-MS, HPLC, in vitro bioaccessibility methods, Rancimat, enzyme studies, chemical and sensory analyses.

Rodica Olar , 

Department of Inorganic Chemistry, Faculty of Chemistry, University of Bucharest, Romania

 (<https://www.scopus.com/authid/detail.uri?authorId=6603223507>)

Research interest: complex combinations – synthesis, psycho-chemical characterization, structure determination, biological use

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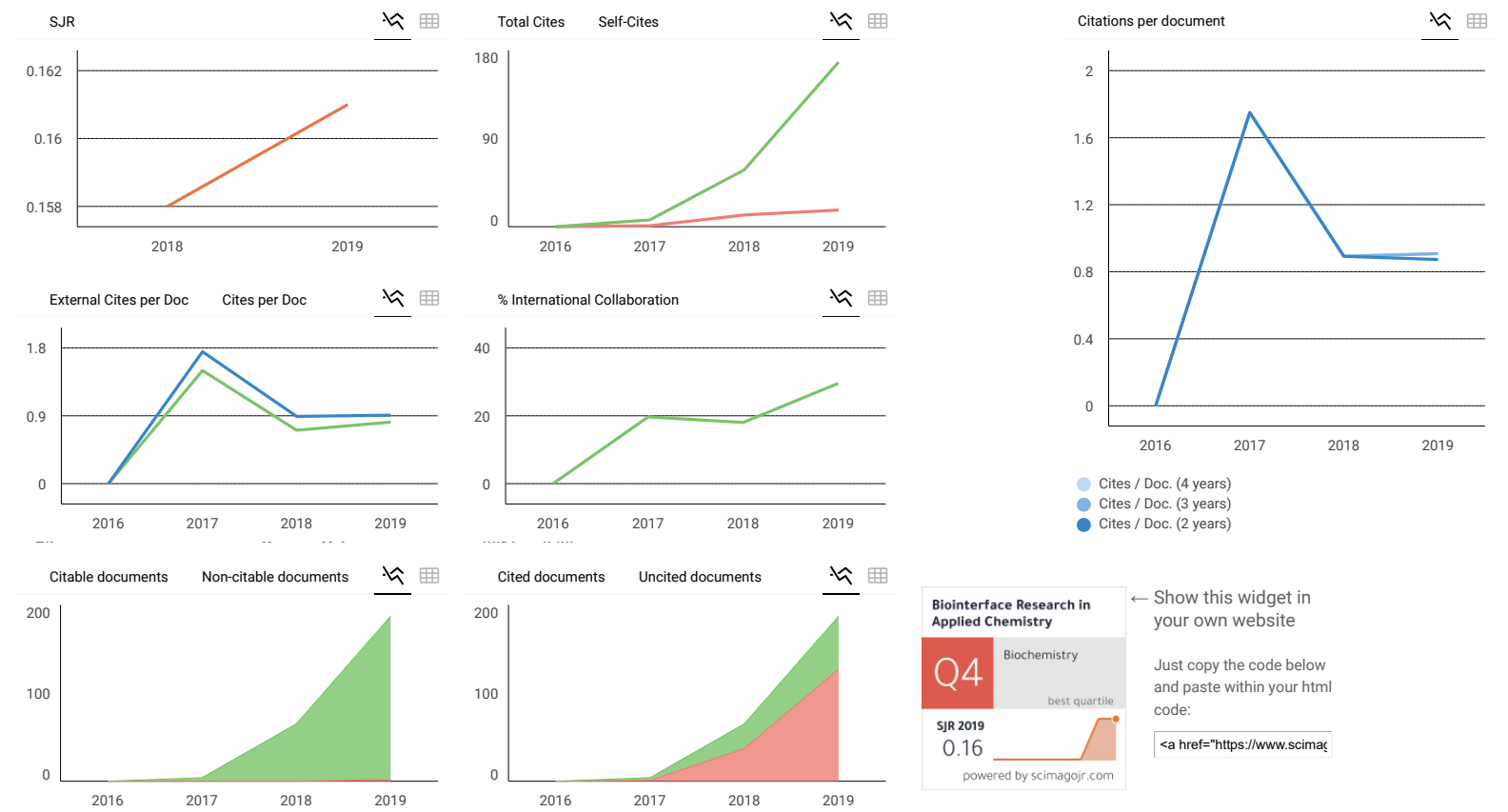
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reply

 **Melanie Ortiz** 2 weeks ago

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M **Manoranjan Behera** 4 weeks ago

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1 message

Alex Grumezescu <al.grumezescu@gmail.com>

Thu, Apr 8, 2021 at 12:36 PM

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