

DEBASISH SARKAR, Ph.D

Professor

Date of Birth – 12th December 1972

KEY SKILLS

- Nanoparticles
- Ceramic Processing and Fabrication
- Microstructure and Mechanical Properties Simulation
- Design and Analysis of Structural Ceramics

FIELD OF INTEREST

Nanomaterials, Structural Ceramics, Bioceramics, Refractories

CONTACT DETAILS

Department of Ceramic Engineering
National Institute of Technology
Rourkela – 769008, Odisha, INDIA

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ACADEMIC

Ph.D (Ceramic Engineering) – National Institute of Technology, Rourkela, INDIA, August 2004 – February 2007

M.Tech (Materials and Metallurgical Engineering) – Indian Institute of Technology, Kanpur, INDIA, May 2002 – May 2004

B.Tech (Ceramic Engineering) – University of Calcutta, Kolkata, INDIA, July 1993 – July 1996

B.Sc (Chemistry Honours) – University of Calcutta, Kolkata, INDIA, May 1990 – June 1993

PROFESSIONAL EXPERIENCE

| | | |
|---------------------------|--------------------------------------|--------------------------|
| Professor | Dept. of Ceramic Engg. NIT, Rourkela | February 2018 - Continue |
| Associate Professor | Dept. of Ceramic Engg. NIT, Rourkela | April 2012 – Jan 2018 |
| Assistant Professor | Dept. of Ceramic Engg. NIT, Rourkela | April 2009 – March 2012 |
| Postdoctoral Fellow (EOL) | KRISS, Daejeon, South Korea | May 2007 – July 2009 |
| Senior Lecturer | Dept. of Ceramic Engg. NIT, Rourkela | July 2006 – April 2009 |
| Lecturer | Dept. of Ceramic Engg. NIT, Rourkela | July 1998 – June 2006 |
| R & D Manager | Sarvesh Refractory (P) Ltd | May 1996 – June 1998 |

SPONSORED PROJECT (Principle Investigator)

- Project Title: **Mechanochemical Milling and Low-Temperature Sintering of Nanostructured MgAl₂O₄**
Project Cost and Status – Rs. 41.36 Lakh, (USD = 75,000), Sanctioned for 3 years (April 2018 – March 2021)
Sponsoring Agency – DST, Govt. of India. EEQ/2017/000028.
- Project Title: **Manufacturing of patient-specific Zirconia toughened Alumina-based femoral ball head prototype development.**
Project Cost and Status –Rs.51.57Lakh (USD – 80,000); Sanctioned for 5 years (2015 – 2020)
Sponsoring Agency –Department of Biotechnology, Govt. of India, BT/PR13466/COE/34/26/2015
- Project Title: **Development of Low – Carbon Steel Plant Refractories with Non-oxide Ceramic Additives**
Project Cost and Status – Rs.109.00Lakh (USD – 192,000); Completed (2012 – 2015)
Sponsoring Agency – Technology Systems Development programs, DST with **Tata Krosaki RefractoriesLtd, Belpahar, Orissa**, DST/TSG/Ceramic/2011/142-G
- Project Title: **Development of Polycrystalline Nd: YAG Transparent Ceramics for Solid-State Laser**
Project Cost and Status – Rs.5.20Lakh (USD – 8,000); Completed (2012 – 2014)
Sponsoring Agency – Board of Nuclear Research and Science, Govt. of India, 2012/34/46/BRNS
- Project Title: **Synthesis and Characterization of Perovskite Nanopowders and Nanocolloids**
Project Cost and Status – Rs.19.20 Lakh (USD – 34,000); Completed (2010 – 2013)
Sponsoring Agency – Department of Science and Technology (DST), Govt. of India, SR/FTP/ETA-088/2009

SPONSORED PROJECT (Co-Principle Investigator)

- Project Title: **Lattice strain engineering in NIR-upconverting core-shell nanocrystals for maximum luminescence output**
Project Cost – 50 lakh, (2023-2026), Approved.
Sponsoring Agency – Department of Science and Technology (DST), Govt. of India,

- Project Title: **Development of Nano Carbon Containing Magnesia Carbon Refractories**
Project Cost and Status – Rs. 92.367 Lakh (USD – 162,000); Completed (2012 – 2015)
Sponsoring Agency – Technology Systems Development programs, DST with **Tata Krosaki Refractories Ltd, Belpahar, Orissa, DST/TSG/Ceramic/2012/143**
- Project Title: **Processing and Characterization of Ni-Cu-Zn Ferrite Powder for MLCI Application**
Project Cost and Status – Rs. 7.68,000, Completed (2003- 2006)
Sponsoring Agency – Department of Science and Technology (DST), Govt. of India,

Consultancy Project (Principle Investigator)

- Project Title: **Corrosion Kinetics and Atmospheric Influence on Thermo-Mechanical behavior of MgO-C (Graphene) Refractories**
Project Cost and Status: Rs. 10.00 Lakh, Completed (2017 - 2019)
Sponsoring Agency: Tata Steel, Jamshedpur.

Laboratory for Ceramic Processing and Engineering, CR-116, Department of Ceramic Engineering, NIT Rourkela

1. Nanoscale powder synthesis (wet and dry),
2. Lyophilizer Refrigerated Centrifuge (267K),
3. Planetary Micro Mill (WC, Al₂O₃, ZrO₂ liner) Pulverisette-7 FRITSCH Germany,
4. Warm Press (340oC, 25ton) Carver USA,
5. Controlled Atmosphere Furnace (2200oC, Ar, N₂, Vacuum), Nabertherm, Germany,
6. High Temperature Furnaces (1800oC, 1650oC, 1100oC),
7. Polishing Facilities for Discs and Truncated Sphere,
8. Polishing Unit,
9. Hardness Tester,
10. Computational Facilities

THESIS SUPERVISION

Doctorate of Philosophy (Ph.D)

- K Sarathchandra, (Thesis Submission 2022 December)
Project Topic: **Ceramic reinforcements for modern Al₂O₃-MgO-C refractories (tentative).**
- Shekh Akbar Basha (Degree Awarded on 14th June 2021)
Thesis: **Design, Composition Optimization, Fabrication and Properties of Al₂O₃/ZrO₂/SrO based Articulating Hip Prosthesis**
- Bhimavarapu Sambireddy (Degree Awarded on 23rd April 2016)
Thesis: **Zirconia toughened Alumina based Femoral Head and Acetabular Socket: Process optimization, Designing, Fabrication and Properties.**
- Sangeeta Adhikari (Degree Awarded on 1st December 2015)
Thesis: **Nanostructured WO₃ for Electrochromic and Photocatalytic Applications**
- Sanjaya Kumar Swain (Degree Awarded on 10th January 2014)
Thesis: **Hydroxyapatite nanoparticles and nanobiocomposites for BSA protein adsorption/release**

Executive Ph.D Scholars (Industrial Professionals):

- Subhash Maity (2021); Project: Rapid setting – high strength Castables
Host Organization: **Imerys India Pvt Ltd, Vizag, India.**
- Kushal Agarwal, (Enrolled 2020); Project Topic: Flow Control Refractories
Host Organization: **Sarvesh Refractories Pvt. Ltd, Rourkela**
- Rajeswar Pramanik (Enrolled 2020); Project Topic: **ASC Castables from steel sector waste**
Host Organization: **Refratechnik India Pvt. Ltd, Visakhapatnam, India**
- Mahasin Hossain (Enrolled 2020); Project Topic: **Spinel – C refractories to control Marangoni effect**
Host Organization: **Jindal Steel Works, Dolby, Mumbai.**
- Goutam Ghosh (Enrolled 2019); Project Topic: **Graphene-based Low carbon MgO-C refractories For Steel Ladle**
Host Organization: **Tata Steel, Jamshedpur.**

Master of Technology (M.Tech/ M.Tech (Res)) – 15 No.s

Bachelor of Technology (B.Tech)

- More than 70 number of project reports have been completed for the fulfilment of B.Tech degree of UG students.
- Mr. T. Satish Kumar received 100 best student award by TCS, India for undergraduate project work 2016.

THEORY COURSES TAUGHT/DEVELOPED

- Nanoscience and Nanotechnology – UG/PG
- Tribology of Materials – PG
- Mechanical behaviour of Ceramics - PG
- Industrial Application of Refractories – PG
- Refractories for Metallurgy and Allied Industries – PG
- Oxide and Non-oxide Ceramics - PG

LABORATORY/EXPERIMENT DEVELOPED

- Furnace Design and Drawing Lab - UG
- Product Design Lab - PG
- Powder Synthesis Lab – UG/PG
- Advanced Ceramic Laboratories – UG
- Design and Failure Analysis Laboratory

PROFESSIONAL ACHIEVEMENTS

- Guest Expert on Ceramic Processing and Engineering for High Power Lasers, Hilase, Czech Republic, Jan – Dec 2019.
- **Materials Research Society of India (MRSI) Medal, 2016** for recent work on patient-specific Orthopaedic implants.
- Life Membership of Indian Institute of Metals
- Life Membership of American Ceramic Society
- Life Membership of Indian Ceramic Society
- H – Index – 28, i10- index – 52, Total citation ~2319.
- Publication in Peer Reviewed International Journal –70; Symposium/Conference – 10; Patent –6
- Research article selected for Hispanicbusiness news and Globalmedical Discovery site
- Single Author Publication at Journal of American Ceramic Society
- Paper selected in Top-25 Elsevier Publication; Oct - Dec 2007.
- First Prize on National Technical Paper Contest 2003 (ASM International).
- National Scholarship award at Undergraduate B.Tech level, 1996.
- Gold Medal to aware highest mark in B.Sc. Chemistry Honors

PROFESSIONAL SERVICES

- Principal Committee member of Bureau of Indian Standards (BIS) 2021.
- Technical Committee member of Fourth International Conference on Nanotechnology for Better Living, Indian Institute of Technology Kanpur, India, November 21-23, 2018.
- Organizing Committee Member for the International Conference on Psychiatry and psychology health Chicago, USA, August 23-25, 2018.
- Organizing Committee Member for the International Conference on Biomaterials August 16-18, 2018, Holiday Inn London - Brentford Lock, London, UK.
- NATIONAL ADVISORY COMMITTEE MEMBER IN "6th Asian Biomaterials Congress : ABMC 6" OCTOBER 25-27, 2017. THIRUVANANTHAPURAM, INDIA
- 18TH DECEMBER 2017, PH.D THESIS EVALUATION AT UNIVERSITY OF HYDERABAD, Mr. Koushi Kumar
- Reviewer for the 2014 Global Conference on Polymer and Composite Materials (PCM 2014), Ningbo, China.
- Organizing Committee member for 'International Conference on Application of Materials Science and Environmental Materials (AMSEM2014)', Hubei, China
- Question/answer preparation for the recruiting organization and conduct the graduate engineering trainee recruitment.
- Reviewer of different SCI journals; RSC – Soft Matter, ACS – Industrial and Engineering of Chemistry, Journal of American Ceramic Society, International Journal of Applied Ceramic Technology, Journal of Materials Processing Technology, Materials Research Bulletin, Materials Letters, Journal of Solid State Chemistry, Journal of Non-crystalline Solids, etc.

- Editorial Board Member of The Scientific World Journal for Material Science
- Editorial Board Member of Science Publishing Group - Journal of Water Resources and Ocean Science

ADMINISTRATIVE RESPONSIBILITIES AND CONTRIBUTION

- Faculty Advisor of UG/PG student - July 2011 – June 2016
- Malpractice Committee member – July 2012 – June 2014
- Department Academic Committee member – July 2011 – June 2014
- Patent committee member – July 2016 – June 2018
- **Head of the Department (Ceramic Engineering) – July 2019 – June 2022**
 - ✓ PG Accreditation for 6years
 - ✓ Managing fund (Rs.1.85Crore) to procure new XRD and BET for Central Research Facility (CRF)
 - ✓ Arrange one month sponsored training program of Bangladesh Council of Scientific and Industrial Research, Bangladesh, 25th May – 23rd June 2022, in the capacity of Training program convener.
 - ✓ Systematically arranged and balanced UG/PG online and offline classes during Covid period, 2019-2021.
 - ✓ Installation of CCTV to avoid unwanted circumstances in the department
 - ✓ Chairman of Webinar on Opportunities in Bioceramic Materials in Orthopedic, Dental and Tissue Engineering Application (OBMODTEA 2020), by Prof. Sudip Dasgupta, Department of Ceramic Engg, NIT Rourkela, September 2020.
 - ✓ Chairman of Webinar on National Webinar on Lithium-ion Batteries and Beyond: A Perspective for Future Energy Storage Need, by Prof. Partha Saha, Department of Ceramic Engg, NIT Rourkela June 2022.
 - ✓ Dual UG and PG students got the highest job CTC of 20Lakh in Tata Cliq, 2022.
 - ✓ An excellent facility development for meeting and online class
- **Head of Centre for Nanomaterials – July 2020 – June 2023**
 - ✓ Published more than 30 publications through this center
 - ✓ 42 number of faculties from 13 departments involved and developed a program in Nanomaterials

INDUSTRY – ACADEMIA ACTIVITIES

- One-month training Program for BCSIR, 25th May 2022 – 23rd June 2022.
- Project evaluation Anvikshna: Grant- in- Aid Minor Research Project on 19-07-2022 on Virtual Mode from 2:00 PM onwards as External Expert for the Evaluation of Nanotechnology project.
- IIT Gandhinagar, MSE Series Lecture, 'Ceramic Particles, Processing and Prototype Validation', 20th Jan 2022, 4pm.
- NIT Raipur Thesis evaluation, January 2022
- Talk on 'Industry 4.0: Technology and innovation in ceramics industry', Aditya Birla Insulators, Celebration of REPRISM 2021 of ABG, Rishra, West Bengal, India, 6th October 2021.
- DEBASISH SARKAR, Tailor-made Hip Prosthesis, World Nano Congress on Advanced Science and Technology - WNCST 2021, March 8-13th 2021, Centre for Nanotechnology Research, VIT, Vellore - 632014, Tamil Nadu, India

PEER-REVIEWED INTERNATIONAL JOURNAL PUBLICATION

1. Preeti Verma, Subhajit Raut, **Debasish Sarkar**, Parasmani Rajput, Manvendra N. Singh, Sujay Chakravarty, Rajendra Sharma, Supratim Giri, Tracing Local Disorder in Near-Infrared-Upconverting Crystals of Li⁺-Doped Gd₂O₃ through the Gd(III)-O Bond Distance, **J. Phys. Chem. C**, 2022, 126, 46, 19849–19857 (*IF – 4.78*).
2. Mula Raju, K. Sarath Chandra, Tapas Mahata, **Debasish Sarkar**, Himadri Sekhar Maiti, Improvement in the properties of low carbon MgO-C refractories through the addition of graphite-SiC micro-composite, **J. Eur Ceram Soc**, 42, 4, 2022, 1804-1814, (*IF – 6.34*).
3. K S Chandra, **D Sarkar**, Strong and Tough Al₂O₃-MgO-C Refractories with Dispersed Aluminosilicate Reinforcement, **J Mat Chem Phy**, 277, 125493, 2022 (*IF – 4.78*).
4. P. Verma, **D. Sarkar**, P. Rajput, M. N. Singh, R. Sharma, S. Giri, "Local disorder affecting NIR-upconverting white light emission manifests in lattice strain", **J. Phys. Chem. C**, 125, 38, 21211–21222, 2021 (*IF – 4.13*).
5. Nibedita Nayak, Shaik Akbar Basha, Surya Kant Tripathi, Bijesh K. Biswal, Monalisa Mishra, **Debasish Sarkar**, Non-Cytotoxic and Non-Genotoxic wear debris of Strontium oxide doped (Zirconia Toughened Alumina) (SrO-ZTA) implant for Hip Prosthesis, **Materials Chemistry and Physics**, 274, 125187, 2021 (*IF – 4.78*).
6. K S Chandra, **D Sarkar**, Oxidation resistance, residual strength, and microstructural evolution in Al₂O₃-MgO-C refractory composites with YAG nanopowder, **Journal of the European Ceramic Society**, 41, 3782-3797, 2021 (*IF – 6.34*).

7. S. Peddarasi, **D. Sarkar**, Mechanochemical effect on synthesis and sintering behavior of $MgAl_2O_4$ spinel, *Materials Chemistry and Physics*, 262, 124275, 2021 (IF – 4.78).
8. M. Raju, S. Sen, **D. Sarkar**, C. Jacob, Synthesis of 3C-silicon carbide 1D structures by carbothermal reduction process, *Journal of Alloys and Compounds*, 857, 158243, 2021 (IF – 6.37).
9. KS Chandra, **D Sarkar**, Structural properties of Al_2O_3 - MgO - C refractory composites improved with YAG nanoparticle hybridized expandable graphite, *Materials Science and Engineering: A*, 803, 140502, 2021 (IF – 6.04).
10. S. A. Basha, A. K. Agrawal, **D. Sarkar**, Tailor-made design, fabrication and validation of SrO doped nanostructured ZTA ceramic Femoral head – Acetabular socket liner assembly, *J of Mechanical Behavior of Biomedical Mat*, 114, 104178, 2021 (IF – 4.042).
11. S. A. Basha, **D. Sarkar**, Critical load and wear regime of hydrothermal-aged SrO-doped ZTA composite, *International Journal of Modern Physics B*, 35, 2150016, 2021 (IF – 1.22).
12. P. Verma, **D. Sarkar**, P. Rajput, M. N. Singh, R. Sharma, S. Giri, Structural Insights of Li^+ Doped Crystals of Upconverting $NaYF_4:Yb^{3+}/M^{3+}(M^{3+}=Er^{3+} \text{ or } Tm^{3+})$ through Extensive Synchrotron Radiation-based X-Ray Probing, *Cry Engg Comm*, 2020, 20, 1, 468–478 (IF – 3.76).
13. SA Basha, **D. Sarkar**, Competitive life time assessment of SrO-ZTA/SrO-ZTA and CoCrMo/UHMWPE hip prosthesis bearings, *J of Mechanics in Medicine and Biology*, 20, 2050009, 2020 (IF – 0.89).
14. S. A. Basha, KS. Chandra, **D. Sarkar**, Salient features of SrO doping in Al_2O_3 -5 wt.% ZrO_2 reaction sintered composite ceramics, *J of Alloys and Compounds*, 829, 154559, 2020 (IF – 6.37).
15. S. A. Basha, **D. Sarkar**, Grain growth suppression of ZTA by multi-step sintering, *Materials Today: Proceedings*, 26, 1226-1230, 2020 (IF – 1.24).
16. P. Verma, **D. Sarkar**, P. Rajput, M. N. Singh, R. Sharma, S. Giri, Synchrotron-Based X-ray Analysis: Relating Compressive Lattice Strain with the Photoluminescence Intensity of Li^+ -Doped β - $NaYF_4:Yb^{3+}/Ln^{3+}$ ($Ln^{3+} = Ho^{3+}/Er^{3+}/Tm^{3+}$) Upconversion Crystals, *Cryst. Growth Des*, 20, 468-478, 2020 (IF – 4.07).
17. KS Chandra, M Monalisa, CVA Chowdary, G Ghosh, **D Sarkar**, Microstructure and Mechanical Behaviour of SrO doped Al_2O_3 Ceramics, *Materials Science and Engineering: A*, 739,186-192, 2019 (IF – 6.04).
18. Nitu Bhaskar, Debasish Sarkar, Bikramjit Basu, Probing cytocompatibility, hemocompatibility and quantitative inflammatory response in Mus musculus towards oxide bioceramic wear particulates and a comparison with CoCr", *ACS Biomater. Sci. Eng.* 4, 9, 3194-3210, 2018 (IF – 4.75).
19. S. Adhikari, S. Sarath, **D. Sarkar**, D. H. Kim, G. Madras, Understanding the morphological effects of WO_3 photocatalysts for the degradation of organic pollutants, *Advanced Powder Technology*, 29, 7, 1591-1600, 2018 (IF – 4.84).
20. S. Adhikari, N. K. R. Eswar, S. Sangita, **D.Sarkar**, G. Madras, Investigation of nano Ag-decorated SiC particles for photoelectrocatalytic dye degradation and bacterial inactivation , *Journal of Photochemistry and Photobiology A: Chemistry*, 357, 118-131, 2018 (IF – 4.29).
21. K. Ravi, **D. Sarkar**, B. Basu, ZrO_2 toughened Al_2O_3 composites with better fracture and wear resistance properties, *Journal of Biomaterials Applications*, 32 (9)1174-1186, 2018 (IF – 2.65).
22. T. Satish, **D. Sarkar**, Computer-aided design, finite element analysis and material-model optimisation of knee prosthesis, *J Australian Ceramic Society*, 54(3), 429-438, 2018 (IF – 1.31).
23. **D. Sarkar**, B. S. Reddy, B. Basu, Implementing statistical modelling approach towards development of ultrafine grained bioceramics: Case of ZrO_2 -toughened Al_2O_3 , *J American Ceramic Society*, 101 [3] 1333-1343, 2018 (IF – 3.50).
24. S. Adhikari, **D. Sarkar**, G. Madras, Hierarchical design of CuS architectures for visible light photocatalysis of 4-chlorophenol, *ACS Omega*, 2, 4009–4021, 2017. (IF – 3.51)
25. K. Sarath, M. Monalisa, G. Ulahannan, **D. Sarkar**, H. S. Maiti, Preparation of YAG Nanopowder by Different Routes and Evaluation of their Characteristics including Transparency after Sintering, *J Australian Ceram Soc*, 53, 751-760, 2017 (IF – 1.31).
26. S. Adhikari, S. Mandal, **D. Sarkar**, D. H. Kim, G. Madras, Kinetics and Mechanism of Dye Adsorption on WO_3 nanoparticles, *Applied Surface Science*, 420, 472–482, 2017 (IF – 6.61).
27. **D. Sarkar**, S. Mandal, B.S. Reddy, N. Bhaskar, D. Sundaresh, B. Basu, ZrO_2 -toughened Al_2O_3 -based near-net shaped femoral head: Unique fabrication approach, 3D microstructure, burst strength, *Materials Sc. & Engineering C*. 77 [1] 1216-1227, 2017 (IF – 7.33).

28. S. Adhikari, R. Swain, **D. Sarkar**, G. Madras, Wedge-like WO₃ architectures for efficient electrochromism and photoelectrocatalytic activity towards water pollutants, **Molecular Catalysis A** 432, 76-87, 2017 (*IF – 5.06*).
29. S. Adhikari, R. Gupta, A.Surin, T. Satish Kumar, S. Chakraborty, **D.Sarkar**, G. Madras, Visible light assisted improved photocatalytic activity of combustion synthesized spongy-ZnO towards dye degradation and bacterial inactivation, **RSC Advances**; 6, 80086-80098, 2016 (*IF – 3.36*)
30. **D. Sarkar**, B.S. Reddy, S. Mandal, M. Ravisankar, B. Basu, Uniaxial compaction based manufacturing strategy and 3D microstructural evaluation of near-net shaped ZrO₂-toughened Al₂O₃ acetabular socket, **Adv. Eng. Mat.**18, 1634, 2016 (*IF – 3.22*).
31. S. Adhikari, A. Banerjee, K. R. Eswar, **D. Sarkar**, G. Madras, Photocatalytic inactivation of E. Coli by ZnO–Ag nanoparticles under solar radiation, **RSC Advances**; 5, 51067 – 51077, 2015 (*IF – 3.36*)
32. S. Adhikari, **D. Sarkar**, G. Madras, Highly efficient WO₃-ZnO mixed oxides for photocatalysis, **RSC Advances**; 5, 11895 -11904, 2015 (*IF – 3.36*)
33. S. Adhikari, **D. Sarkar**, Metal Oxide Semiconductors for Dye Degradation, **Mat. Research Bulletin**; 72, 220-228, 2015 (*IF – 4.02*).
34. S. Adhikari, **D. Sarkar**, Preparation of Mixed Semiconductors for Methyl Orange Degradation, **Journal of Nanomaterials**; 2015, 269019, 2015 (*IF – 2.23*)
35. S. K. Swain, S. Bhattachryya and **D. Sarkar**, Fabrication of porous hydroxyapatite scaffold via polyethylene glycol-polyvinyl alcohol hydrogel state, **Material Research Bulletin**; 64, 257-261, 2015 (*IF – 3.36*).
36. S. Adhikari, **D. Sarkar**, Confined Growth of WO₃ for High-Performance Electrochromic Device, **Key Engineering Materials**; 659, 583-587, 2015 (*IF – 0.35*).
37. S. Adhikari, **D. Sarkar**, Synthesis and Electrochemical Properties of Nanocuboid and Nanofiber WO₃, **Journal of The Electrochemical Society**; 162, H1-H7, 2014 (*IF – 3.66*).
38. S. Adhikari, **D. Sarkar**, G. Madras, Synthesis and Photocatalytic performance of Quasi-fibrous ZnO, **RSC Advances**, 4, 55807-55814, 2014 (*IF – 3.05*).
39. S. Adhikari, **D. Sarkar**, High Efficient Electrochromic WO₃ Nanofibers, **Electrochimica Acta**, 138, 115-123, 2014 (*IF – 6.90*).
40. S. Adhikari, **D. Sarkar**, Hydrothermal synthesis and Electrochromism of WO₃ nanocuboids, **RSC Advances**, 4, 20145, 2014 (*IF 3.05*).
41. S. Adhikari, **D. Sarkar**, H.S.Maiti, Synthesis and Characterization of WO₃ Spherical Nanoparticles and Nanorods, **Materials Research Bulletin**, 49, 325-330, 2014 (*IF – 3.36*).
42. S. Swain, **D. Sarkar**, Fabrication, bioactivity, in vitro cytotoxicity and cell viability of cryo-treated nanohydroxyapatite–gelatin–polyvinyl alcohol macroporous scaffold, **Journal of Asian Ceramic Societies**, 2, 241-247, 2014 (*IF – 2.60*).
43. S. Adhikari, **D. Sarkar**, Electrochemical response of spherical and rod shaped WO₃ nanoparticles, **International Scholarly Research Notices**, 2013, 279398, 2013.
44. S. Swain, **D. Sarkar**, Study of BSA protein adsorption/release behavior of hydroxyapatite nanoparticles, **Applied Surface Science**, 286, 99-103, 2013 (*IF – 6.18*).
45. B. Basu, S. K. Swain, **D. Sarkar**, Cryogenically cured Hydroxyapatite-gelatin nanobiocomposite for BSA Protein adsorption/release, **RSC Advances**, 3, 14622-14633, 2013 (*IF – 3.05*).
46. **D. Sarkar**, S. K. Swain, S. Adhikari, B. S. Reddy, H.S. Maiti, Synthesis, mechanical properties and bioactivity of nanostructured zirconia, **Material Science and Engineering – C**, 33 [6] 3413 – 3417, 2013 (*IF – 7.33*).
47. S. Swain, **D. Sarkar**, Preparation of nanohydroxyapatite – gelatin porous scaffold and mechanical properties at cryogenic environment, **Materials Letters**, 92, 252–254, 2013. (*IF- 3.42*).
48. S. K Swain, S. V. Dorozhkin, **D. Sarkar**, Synthesis and Dispersion of Hydroxyapatite Nanopowders, **Material Science and Engineering – C**, 32 [5] 1237 – 1240, 2012 (*IF – 7.33*).
49. S. Swain, **D. Sarkar**, A Comparative Study: Hydroxyapatite Spherical Nano Powders and Elongated Nano Rods, **Ceramics International**, 37 [7] 2927 – 2930, 2011 (*IF –3.64*).
50. S. K. Swain, S. Bhattachryya and **D. Sarkar**, Preparation of Porous Scaffold from Hydroxyapatite Powders, **Material Science and Engineering – C**, 31 [6] 1240 – 1244, 2011 (*IF – 7.33*).
51. **D. Sarkar**, Synthesis and Properties of BaTiO₃ Nanopowders, **J of American Ceram Soc.**, 94 [1] 106-110, 2011 (*IF – 3.09*).

52. R. Tadi, Y-I. Kim, **D. Sarkar**, C. Kim, K-S. Ryu, Magnetic and electrical properties of bulk BaTiO₃-MgFe₂O₄ composite, *J Magnetism and Magnetic Materials*, 323 [5] 564-568, 2011 (*IF – 2.68*).
53. **D. Sarkar**, M.C. Chu, S.J.Cho, Y-I. Kim and B.Basu, Synthesis and Morphological Analysis of TiC Nanopowders, *J of American Ceram Soc.*,92 [12], 2877 – 2882, 2009 (*IF – 3.50*).
54. **D. Sarkar**, A. Padhiary, S.J.Cho, M.C. Chu, Oxidation-Induced Strength Behavior of Ti₃SiC₂, *J Materials Processing Technology*, 209 [2], 641-646, 2009 (*IF – 4.18*).
55. **D. Sarkar**, S.Adak, N.K.Mitra, Preparation and Characterization of Al₂O₃-ZrO₂ Nanocomposite, Part I: Powder Synthesis and Transformation Behavior During Fracture, *Composites: Part A*, 38[1]124–131, 2007(*IF – 7.67*).
56. **D. Sarkar**, B.Basu, M.C.Chu and S.J.Cho, Is glass infiltration beneficial to improve Fretting wear Properties for Alumina? *J of American Ceram Soc*, 90 [2] 523–532, 2007 (*IF – 3.09*).
57. D. Mohapatra, **D. Sarkar**, Effect of in situ spinel seeding on synthesis of MgO-rich MgAl₂O₄ composite, *Journal of materials science*, 42 (17), 7286-7293, 2007(*IF –3.44*).
58. **D. Sarkar**, B.Basu, M.J.Chu and S.J.Cho, R-Curve Behavior of Ti₃SiC₂, *Ceramic International*; 33 [5] 789 -793, 2007(*IF –3.64*).
59. **D. Sarkar**, S.Adak, S.J. Cho., M. C. Chu, N.K.Mitra, Influence of ZrO₂ content and grain size on the thermo-mechanical properties of Nano-ZTA, *Ceramics International*,33, [2] 255-261, 2007(*IF –3.64*).
60. D. Mohapatra, **D. Sarkar**, Preparation of MgO-MgAl₂O₄ Composite for Refractory Application, *J Materials Processing Technology*, 189 [1-3] 279-283,2007(*IF – 4.18*).
61. Debasish Sarkar, Deepak Mohapatra, Sambarta Ray, Santanu Bhattacharyya, Sukumar Adak, Niren Mitra, Synthesis and Characterization of Sol–Gel Derived ZrO₂ Doped Al₂O₃ Nanopowder, *Ceramics International* 33, 1275-1282 , 2007 (*IF – 3.64*)
62. **D. Sarkar**, B V Manoj Kumar and B.Basu, Understanding the fretting damage of Ti₃SiC₂, *J European Ceramic Society*, 26[13] 2441-2452, 2006 (*IF – 4.03*).
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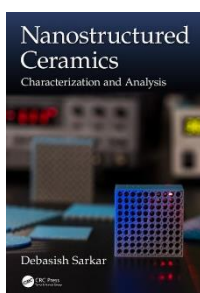
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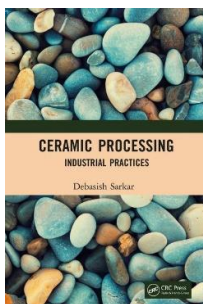
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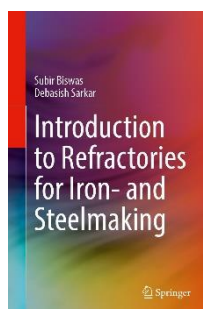
This book comprehensively accounts for the solved numerical and brainstorming unsolved (partial hints) problem to boost the data interpretation skill. One can envisage the correlation between the synthesis process and properties in the perspective of nanostructured ceramics for energy, environment, and health materials. Therefore, it should serve as a concise text to answer the basics and achieve research goals for academia and industrial research.

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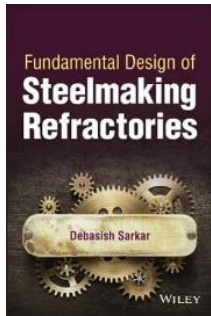
The radical changes by the fast progressing disruptive technologies and the rapid developments of the newer dimensions of Ceramics have given birth to the need of writing this book. The Manufacturing Sectors, including Ceramics, are at the crossroad due to adopting the high-level automation and implementations of the niche & unconventional technologies. On the other hand, the relentless quest of the human mind never allows Science & Technologies to rest in peace. So the paradigm shifts. To keep the knowledge seekers abreast with the latest trends, developments & additions in the fields of Ceramics has been an attempt to capture a few of them in some very carefully selected chapters. This book starts with a piece of introductory information on '*manufacturing excellence in ceramic industry*' followed by '*particle management*', one of the most critical steps for ceramic processing. In brief, the processing protocols have been taken into account for manufacturing a wide range of bulk ceramics, starting from highly dense (*transparent ceramics*) to low dense (*porous ceramics*) ceramics followed by two dimensional '*ceramic coatings*'. Furthermore, the traditional and advanced ceramics including '*refractories and failures*', '*whitewares and glazes*', '*glasses and properties*', '*miniaturization of complex ceramics*' and '*structural and functional prototypes*' are also encountered and discussed. The topics are chosen and completed the book through brainstorming discussion with distinguished industrial personalities, academia, and researchers around the globe.

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This book encompasses the heat and mass transfer mechanism, understanding the effect of impurities and formation of secondary phases, and unaccounted invisible defects during refractory manufacturing. It eventually facilitates understanding the wear, corrosion, and performance analysis of different refractory linings for LF, BOF, Tundish, and continuous casting refractories. Such a book would benefit the raw material and refractory manufacturers, steelmaking sectors, process engineers, and technicians in the steel industry, aiding in fabricating higher quality refractories and graduate students & refractory research scientists as training reference.

Short Biography of Prof. Sarkar

Debasish Sarkar is a Professor at the Department of Ceramic Engineering, National Institute of Technology, Rourkela, Odisha, India. By 2007 Prof. Sarkar had finished his Ph.D. and held a visiting researcher position at the Korea Research Institute of Standards and Science, Daejeon, South Korea. Gaining adequate experience in research, he received the Materials Research Society of India (MRSI) Medal in 2016 for his incredible research work on orthopedic implants. In avidity about research, publications are more than 100, including peer-reviewed international journals, books, book chapters, and national and international patents. Despite extensive nanomaterials research, his recent interest is *Structural Ceramics* in specific bioceramics and refractories development with life assessment and performance monitoring. He is designated as head of the 'Centre for Nanomaterials' at NIT Rourkela, for which he established an excellent team to accomplish high-end products for society.