Curriculum Vitae

Dr. Sanjay R. DHAGE

Scientist "E"
Center for Carbon Materials
International advanced Research Center for Power Metallurgy and New Materials (ARCI)
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Academic qualification

2005 Doctor of Philosophy (Ph.D.) in Materials Chemistry from **National Chemical Laboratory (CSIR-NCL) Pune and University of Pune** India.
Dissertation title: Studies on non-linear current-voltage (I-V) characteristics in doped SnO_2 and related system: Synthesis and characterization.

2000 Master of Science (M.Sc.) in Chemistry from **University of Pune**, India.
Specialization: Inorganic Chemistry

1997 Bachelor of Science (B.Sc.) from **Nagpur University**, India.
Major Subjects: Chemistry, Physics and Mathematics

Professional experience

2016 - Till date	*Scientist E* **International advanced Research Center for Power Metallurgy and New Materials (ARCI) PO Balapur, Hyderabad - 500005**
2011 - 2016	*Scientist D* International advanced Research Center for Power Metallurgy and New Materials (ARCI) PO: Balapur, Hyderabad - 500005
2010 - 2011	*Scientist on contract* International advanced Research Center for Power Metallurgy and New Materials (ARCI) PO: Balapur, Hyderabad - 500005
2008 - 2010	*Postdoctoral Researcher* **University of California Los Angeles (UCLA), USA**
2006 - 2008	*Postdoctoral Researcher* **Chonbuk National University (CBNU), South Korea**
2005 – 2006	*Research Associate* **Corporate R&D Center, Bharat Petroleum Corp. Ltd. (BPCL) Noida, India**

Areas of Research Interest

Solar energy materials. CIGS Thin film solar cells. Solar photovoltaic device development. Pilot scale fabrication and prototype development. Selenization/sulfurization. Chalcogenides. Non-vacuum route for thin films. Ink-jet printing of solar cells. Printable Flexible electronics. Laser/Flash light post treatment of thin films. Metal thin films by magnetron sputtering. Transparent conducting oxide (TCO) thin films. 2D nanostructures for sensor application.

Projects/Grants

1. Thin film absorber material and processing (**Sponsored: SERIIUS-JCERDC, 2012-2017**)
2. Nanoink based CIGS solar cells for building integrated PV (BIPV) application. (**Sponsored: DST-Technology Research Center (TRC), 2016-2021**)
3. High temperature sensor for structural health monitoring system **(2019-21)**.
4. Low temperature nanometric gold deposition on zerodur 3-D block for TMT edge sensor **(2020-21)**.
5. Prototype development of CIGS thin film solar module on glass and flexible substrate for DC power applications.

Research profile

- Development of $Cu(In,Ga)Se_2$ thin film solar cells by two step process, sputtering and atmospheric selenization; achieved 13% efficiency on lab scale devices.
- Translation of lab scale results to make monolithically integrated prototype solar modules on large area, successful demonstration of 100 cm^2 module for mobile phone charging application.
- Non-vacuum based Inkjet printable/spray casted copper Indium/Gallium diselenide thin film solar cells: Environmentally benign and low cost approach, achieved 6.7% efficiency on lab devices.
- Implementation of Pulsed laser/Flash light annealing of thin films: Industrially scalable and low cost process.
- Development of highly transparent and conducting Al:ZnO thin film by DC magnetron sputtering on 30 cm^2 area for top contact and window application.
- Room temperature sputtered Al:ZnO thin films with improved transmittance in infrared region for wide band gap optoelectronic devices.
- Highly conducting molybdenum (Mo) thin films on large area (30 cm^2) by magnetron sputtering for metal contact application.
- Development and demonstration of functional cadmium sulfide based Light dependent resistor (LDR) sensor device, CdS/AZO/Glass.
- Development of inkjet printed high temperature sensor on flexible substrates for structural health monitoring system.
- Inkjet printing of conductive ink patterns for sensors on flexible substrates.

Achievements/Awards/Affiliation

Achievements and awards:

1. **Project assistant fellowship 2001** by Department of Science of Technology, Govt of India.
2. **Industrial postdoc fellowship**, Corporate R&D, BPCL India (Jan 2006)
3. **Brain Korea 21 postdoctoral fellowship**, Chonbuk National University, South Korea (Sept 2006)
4. **University postdoctoral fellowship**, University of California Los Angeles, USA (Feb 2008)
5. **Outstanding Researcher in Solar Energy Materials** 6th Venus International Science and Technology Award (VISTA- 2020) (Jan 2021)
6. **Publications in peer-reviewed International/National journals**: 67 (**Total impact factor-189**, **All-together citations above 1710, *h* index -21, h10 index – 36, Source: www.scopus.com**)

Editorial board member of Journals:

1. Current Alternative Energy (ISSN Print: 2405-4631)
2. International Journal of Energy and Environmental Science (ISSN Print: 2578-9538)
3. SCIRES Journal of Energy (Open access)
4. International Journal of Innovative Research and Review (ISSN Online: 2347-4424)

Affiliation to Professional societies:

1. International Solar Energy Society (**ISES**) (No. 6535)
2. Materials Research Society of India (**MRSI**) (No. LMB1784)
3. Solar Energy Society of India (**SESI**) (No. LM2069)
4. Sensor Research Society of India (**SRSI**) (No. 222)
5. Institute of Electrical and Electronic Engineers (**IEEE**) (No. 93497789)

Regular Reviewer of Journals:

1. Solar Energy Materials and Solar cells. 2. Solar Energy. 3. Solar RRL 4. ACS Applied Energy Materials 5. Advanced Energy Materials. 6. Advanced Engineering Materials. 7. Thin Solid Films. 8. Materials Chemistry and Physics. 9. Journal of Alloys and compounds. 10. Superlattice and Microstructures. 10. Journal of Solid State Chemistry. 11. Journal of colloid and interface science. 12. Synthetic metals. 13. Composite science and technology. 14. Journal of composite materials. 15. ACS Applied Materials and Interphases. 16. Nanoscale Research Letters. 17. Review of scientific instruments. 18. Journal of Nanoparticles Research. 19. Journal of Applied Physics 20. Scientific Reports. etc.....

Top 25 most downloaded articles within the journal:

1. **Sanjay R. Dhage,** Vandana D. Choube, Violet Samuel and V. Ravi, Synthesis of nanocrystalline TiO_2 at 100°C, *Mater. Lett.* 58 (17-18) 2310 (2004)
   July-September 2004
2. Violet Samuel, P. Muthukumar S.P. Gaikwad, **S.R. Dhage,** and V. Ravi, Synthesis of mesoporous rutile TiO_2, *Mater. Lett.* 58 (20) 2514 (2004)
   July-September 2004
3. **S.R. Dhage,** Y.B. Khollam, S.B. Dhespande, H.S. Potdar and V. Ravi, Synthesis of bismuth titanate by citrate method, *Mater. Res. Bull.* 39 (13) 1993 (2004)
   October-December 2004
4. **S.R. Dhage** and H. Thomas Hahn, Rapid treatment of CIGS particles by intense pulsed light, *J. Phys. Chem. Solids* 71 (2010) 1480
   July-September 2010, October-December 2010

Thesis supervision

Ph. D thesis: **Completed-2, Ongoing-1**
M. Tech. thesis: **6**
M.Sc./B. Tech. Projects: **9**

Publications/Proceedings/Book chapters

Scopus Author ID: 6701584639, ORCID ID: 0000-0002-5580-6779

1. Chemical co-precipitation of mixed (Pb+Ti) oxalates precursor for the synthesis of PbTiO3 powder, **S. R. Dhage**, Y. B. Khollam, H. S. Potdar, S. B. Deshpande, B. D. Sarwade, and S. K. Date, *Materials Letters 56 (2002) 564–570* (https://doi.org/10.1016/S0167-577X(02)00553-0)
2. Microwave hydrothermal preparation of submicron-sized spherical magnetite (Fe3O4) powders Y.B. Khollam, **S.R. Dhage**, H.S. Potdar, S.B. Deshpande, P.P. Bakare, S.D. Kulkarni, and S.K. Date, *Materials Letters 56 (2002) 571– 577* (https://doi.org/10.1016/S0167-577X(02)00554-2)
3. Effect of variation of molar ratio (pH) on the crystallization of iron oxide phases in microwave hydrothermal synthesis, **S. R. Dhage**, Y. B.Khollam H. S.Potdar, S. B.Deshpande, P. P.Bakare, S. R.Sainkar, and S. K. Date, *Materials Letters 57 (2002) 457– 462* (https://doi.org/10.1016/S0167-577X(02)00811-X)
4. Influence of lanthanum on the nonlinear I-V characteristics of SnO2: Co, Nb, **S. R. Dhage**, V. Ravi and S.K. Date *Materials Letters 57 (2002) 727– 729*, (https://doi.org/10.1016/S0167-577X(02)00861-3)
5. Influence of various donors on nonlinear I-V characteristics of tin dioxide ceramics, **S. R. Dhage** and V. Ravi, *Applied Physics Letters 83 (22) (2003) 4539-4541* (https://doi.org/10.1063/1.1631390)
6. Preparation of microwave dielectric, Sn0.2Zr0.8TiO4, **S. R. Dhage**, V. Ravi and S.K. Date, *Bulletin of Materials Science 26 (2) (2003) 215–216* (https://doi.org/10.1007/BF02707793)
7. Varistors based on doped SnO2, **S. R. Dhage**, Violet Samuel and V. Ravi, *Journal of Electroceramics, 11, 81–87, 2003* (https://doi.org/10.1023/B:JECR.0000015664.21909.1e)
8. Co-precipitation technique for the preparation of nanocrystalline ferroelectric SrBi2Ta2O9, **S. R. Dhage**, Y. B. Khollam, S. B. Deshpande and V. Ravi, *Materials Research Bulletin 38 (2003) 1601–1605*, (https://doi.org/10.1016/S0025-5408(03)00184-3)
9. Synthesis of ultrafine TiO2 by citrate gel method, **S. R. Dhage**, Renu Pasricha and V. Ravi, *Materials Research Bulletin 38 (2003) 1623–1628* (https://doi.org/10.1016/S0025-5408(03)00180-6)
10. Nonlinear I-V characteristics study of doped SnO2, **S. R. Dhage** and V. Ravi and S.K. Date, *Bulletin of Materials Science 27 (1) (2004) 43–45* (https://doi.org/10.1007/BF02708483)
11. Synthesis of nanocrystalline SnO2 powder at 100°C, **S.R. Dhage**, S.P. Gaikwad, Violet Samuel and V. Ravi, *Bulletin of Materials Science 27 (3) (2004) 221–222* (https://doi.org/10.1007/BF02708509)
12. Synthesis of nanocrystalline TiO2 by tartarate gel method, **S.R. Dhage**, S.P. Gaikwad and V.Ravi, *Bulletin of Materials Science 27 (6) (2004) 487–489* (https://doi.org/10.1007/BF02707273)
13. Synthesis of Ce0.75Zr0.25O2 at 100 °C, **S.R. Dhage**, S.P. Gaikwad, P. Muthukumar and V. Ravi, *Ceramics International 31 (2005) 211–213* (https://doi.org/10.1016/j.ceramint.2004.04.009)
14. Synthesis of nanocrystalline TiO2 at 100 °C, **S. R. Dhage**, Vandana D. Choube, Violet Samuel and V. Ravi, *Materials Letters 58 (2004) 2310– 2313* (https://doi.org/10.1016/j.matlet.2004.02.021)
15. Synthesis of mesoporous rutile TiO2, Violet Samuel, P. Muthukumar S.P. Gaikwad, **S.R. Dhage**, and V. Ravi, *Materials Letters 58 (2004) 2514– 2516* (https://doi.org/10.1016/j.matlet.2004.02.040)
16. Synthesis of Ce0.75Zr0.25O2 by citrate gel method, **S.R. Dhage**, S.P. Gaikwad, P. Muthukumar and V. Ravi, Materials Letters 58 (2004) 2704– 2706 (https://doi.org/10.1016/j.matlet.2004.03.037)
17. Synthesis of bismuth titanate by citrate method, **S.R. Dhage**, Y.B. Khollam, S.B. Dhespande, H.S. Potdar and V. Ravi, *Materials Research Bulletin 39 (2004) 1993–1998* (https://doi.org/10.1016/j.materresbull.2004.07.014)
18. Nonlinear I–V characteristics of doped SnO2, **S.R. Dhage**, Vandana Choube, V. Ravi, *Materials Science and Engineering B 110 (2004) 168–171* (https://doi.org/10.1016/j.mseb.2004.02.003)
19. Co-precipitation method for the preparation of nanocrystalline ferroelectric SrBi2Nb2O9 ceramics, S.P. Gaikwad, **S.R. Dhage**, H.S. Potdar,V. Samuel and V. Ravi, *Journal of Electroceramics 14 (2005) 83–87* (https://doi.org/10.1007/s10832-005-6588-y)
20. Co-precipitation method for the preparation of ferroelectric CaBi4Ti4O15, S.P. Gaikwad, **S.R. Dhage** and V. Ravi, *Journal of Materials Science: Materials in Electronics 16 (2005) 229– 231* (https://doi.org/10.1007/s10854-005-0773-2)
21. Synthesis of Sr0.5Ba0.5Nb2O6 by urea method, **S.R. Dhage**, Renu Pasricha and V. Ravi, *Materials Letters 59 (2005) 1053–1055* (https://doi.org/10.1016/j.matlet.2004.12.003)
22. Preparation of ferroelectric BaNb2O6 by the urea method, **S.R. Dhage**, R. Pasricha and V. Ravi, *Materials Letters 59 (2005) 1929– 1931* (https://doi.org/10.1016/j.matlet.2005.02.028)
23. Synthesis of bismuth oxide nanoparticles at 100 °C, M.M. Patil, V.V. Deshpande, **S.R. Dhage** and V.Ravi, *Materials Letters 59 (2005) 2523 – 2525* (https://doi.org/10.1016/j.matlet.2005.03.037)
24. Synthesis of bismuth titanate by the urea method, M. Anilkumar, **S.R. Dhage** and V. Ravi, *Materials Letters 59 (2005) 514– 516* (https://doi.org/10.1016/j.matlet.2004.10.038)

25. Synthesis of fine particles of ZnO at 100 °C, **S.R. Dhage**, Renu Pasricha and V. Ravi, *Materials Letters 59 (2005) 779– 781* (https://doi.org/10.1016/j.matlet.2004.11.019)
26. Studies on SnO2-ZrO2 solid solution, **S. R. Dhage**, Violet Samuel, Renu Pasricha and V. Ravi, *Ceramics International 32 (2006) 939–941* (https://doi.org/10.1016/j.ceramint.2005.06.012)
27. A co-precipitation technique for the preparation of ferroelectric BaBi2Ta2O9, **S.R. Dhage**, R. Pasricha, A.V. Murugan and V. Ravi, *Materials Chemistry and Physics 98 (2006) 344–346* (https://doi.org/10.1016/j.matchemphys.2005.09.036)
28. Low voltage varistor ceramics based on SnO2, **S.R. Dhage***, V. Ravi and O.B. Yang, *Bulletin of Materials Science 30 (6) (2007) 583–586* (https://doi.org/10.1007/s12034-007-0092-8)
29. The influence of surfactant on ZnO Varistor, **S.R. Dhage**, S.C. Navale and V. Ravi, *Ceramics International 33 (2007) 289–291* (https://doi.org/10.1016/j.ceramint.2005.08.010)
30. Varistor property of SnO2.CoO.Ta2O5 ceramic modified by barium and strontium, **S.R. Dhage***, V. Ravi and O.B. Yang, *Journal of Alloys and Compounds 466 (2008) 483–487* (https://doi.org/10.1016/j.jallcom.2007.11.062)
31. Intense pulsed light sintering of copper nanoink for printed electronic technique, H.S. Kim, **S. R. Dhage**, D.E. Shim and H. T. Hahn, *Applied Physics A97 (2009) 791–798* (https://doi.org/10.1007/s00339-009-5360-6)
32. Low temperature fabrication of hexagon shaped h-MoO3 nanorods and its phase transformation, **S.R. Dhage***, M. S. Hassan and O.B. Yang, *Materials Chemistry and Physics 114 (2009) 511–514* (https://doi.org/10.1016/j.matchemphys.2008.10.076)
33. Formation of SiC nanowhiskers by carbothermic reduction of silica with activated carbon, **S.R. Dhage**, H.C. Lee, M.S. Hassan. M.S. Akthar, C.Y. Kim, J. M. Sohn, H.S. Shin and O.B. Yang, *Materials Letters 63 (2009) 174–176* (https://doi.org/10.1016/j.matlet.2008.09.056)
34. Nanocomposites for power laminates, Kim, H.S., Lee, Y.M., **Dhage, S.**, Kang, J.S., Hahn, H.T., *Proceeding of 17th International Conferences on Composite Materials* (*ICCM-17)*
35. Design of optimization of CIGS thin film solar cell using numerical and design of experimental approach, I. Seok, **S. Dhage**, H.S. Kim and H.T. Hahn, *ASME 3rd international conference on Energy and sustainability ES2009-90412 (*https://doi.org/10.1115/ES2009-90412)
36. A simulation study on the direct carbothermal reduction of SiO2 for Si metal, H.C. Lee, **S. Dhage**, M. S. Akhtar, D. H. Kwak, W. J. Lee, C.Y. Kim, O.B. Yang, *Current Applied Physics 10 (2010) S218–S221* (https://doi.org/10.1016/j.cap.2009.11.053)
37. Polypyrrole/silicon carbide nanocomposites with tunable electrical conductivity, P. Mavinakuli, S. Wei Q. Wang, A.B. Karki, **S. Dhage**, Z. Wang, D.P. Young, Z. Guo, *Journal of Physical Chemistry C 114 (2010) 3874–3882* (https://doi.org/10.1021/jp911766y)
38. Rapid treatment of CIGS particles by intense pulsed light, **S.R. Dhage*** and H. Thomas Hahn, *Journal of Physics and Chemistry of Solids 71(2010) 1480-1483* (https://doi.org/10.1016/j.jpcs.2010.07.016)
39. CIGS Thin Film Preparation from CIG Metallic Alloy and Se Nanoparticles by Intense Pulsed Light Technique, **S.R. Dhage***, Hak-Sung Kim and H. Thomas Hahn, *Journal of Electronic Materials 40 (2) (2011) 122-126* (https://doi.org/10.1007/s11664-010-1431-x)
40. Morphological variations in CdS nanocrystals without phase transformation, S.R. Dhage*, H.A. Colorado and H. Thomas Hahn, *Nanoscale Research Letters 6 (2011) 420* (https://doi.org/10.1186/1556-276X-6-420)
41. Thermo chemical stability of CdS nanoparticles under intense pulsed light irradiation and high temperature condition, H.A. Colorado, **S.R. Dhage**, and H. Thomas Hahn, *Materials Science and Engineering B 176 (2011) 1161-1168* (https://doi.org/10.1016/j.mseb.2011.06.003)
42. Photoluminescence properties of thermally stable highly crystalline CdS nanoparticles, **S.R. Dhage***, H.A. Colorado and H. Thomas Hahn, *Materials Research 15(6) (2012) 1-4* (https://doi.org/10.1590/S1516-14392013005000020)
43. Intense pulsed light sintering technique for nanomaterials, H.A. Colorado, **S.R. Dhage**, J.M. Yang and H. Thomas Hahn, *TMS annual meeting 1 (2012) 577-584* (https://doi.org/10.1002/9781118356074.ch74)
44. Fabrication of CIGS thin film absorber by laser treatment of pre-deposited nano-ink precursor layer, **Sanjay R. Dhage***, ManishTak, ShrikantV.Joshi, *Materials Letters 58 (2014) 2310– 2313* (https://doi.org/10.1016/j.matlet.2014.07.107)
45. CIGS absorber layer by single-step non-vacuum intense pulsed light treatment of inkjet-printed film, **Sanjay R. Dhage***, P.S. Chandrasekhar, S.B. Chandrasekhar and Shrikant V. Joshi, *Proceedings of 40th IEEE Photovoltaic Specialist Conference (2014) 1607-1610* (https://doi.org/10.1109/PVSC.2014.6925227)
46. Process parameter impact on properties of sputtered large-area Mo bilayers for CIGS thin film solar cell applications, Amol C. Badgujar, **Sanjay R. Dhage***, Shrikant V. Joshi, *Thin Solid Films 589 (2015) 79–84* (https://doi.org/10.1016/j.tsf.2015.04.046)

47. Non-vacuum route for CIGS thin film absorber on flexible glass substrates, Amol C. Badgujar, K. Madhuri, Sean Garner, **Sanjay R. Dhage*** and Shrikant V. Joshi, *Proceedings of 40th IEEE Photovoltaic Specialist Conference (2015)* (https://doi.org/10.1109/PVSC.2015.7356105)
48. Effect of various surface treatments on adhesion strength of magnetron sputtered bi-layer molybdenum thin films on soda lime glass substrate, B. S. Yadav, Amol C. Badgujar and **Sanjay R. Dhage***, *Solar Energy 157 (2017) 507-513* (https://doi.org/10.1016/j.solener.2017.08.068)
49. Chalcopyrite CIGS absorber layer by inkjet printing for photovoltaic application, B. S. Yadav, Suhash R. Dey and **Sanjay R. Dhage***, *Materials Today Proceedings 4(14) (2017) 12480-12483* (https://doi.org/10.1016/j.matpr.2017.10.047)
50. CdS buffer layer by CBD on 300 mm x 300 mm glass for CIGS solar cell application, P. Uday Bhaskar and **Sanjay R. Dhage***, *Materials Today Proceedings 4(14) (2017) 12525-12528* (https://doi.org/10.1016/j.matpr.2017.10.055)
51. Sonochemical synthesis of CuIn0.7Ga0.3Se2 nanoparticles for thin film absorber application, Amol C. Badgujar, R. O. Dusane and **Sanjay R. Dhage***, *Materials Science in Semiconductor Processing 81 (2018) 17-21* (https://doi.org/10.1016/j.mssp.2018.03.001)
52. Cu(In,Ga)Se2 thin film absorber layer by flash light post-treatment, Amol C. Badgujar, R. O. Dusane and **Sanjay R. Dhage***, *Vacuum 153 (2018) 191-194* (https://doi.org/10.1016/j.vacuum.2018.04.021)
53. Process parameter impact on selective laser ablation of bilayer Molybdenum thin films for CIGS solar cell applications, Amol C. Badgujar, Shrikant V. Joshi and **Sanjay R. Dhage***, *Materials Focus 7(4) (2018) 556-562* (https://doi.org/10.1166/mat.2018.1540)
54. Molybdenum bilayer thin film on large area by cylindrical rotating DC magnetron sputtering for CIGS solar cell application, Amol C. Badgujar, Brijesh singh Yadav, Suhash R Dey, Rajiv O. Dusane and **Sanjay R. Dhage*** *Proceedings of 35th EUPVSEC 2018* (https://doi.org/10.4229/35thEUPVSEC20182018-3BV.2.9)
55. Transparent conducting Al:ZnO thin film on large area by efficient cylindrical rotating DC magnetron sputtering, **Sanjay R. Dhage*** and Amol C. Badgujar, *Journal of Alloys and Compounds 763 (2018) 504–511* (https://doi.org/10.1016/j.jallcom.2018.05.234)
56. Effective ink jet printing of aqueous ink for Cu (In, Ga) Se2 thin film absorber for solar cell application, B. S. Yadav, Suhash R. Dey and **Sanjay R. Dhage***, *Solar Energy 179 (2019) 363-370* (https://doi.org/10.1016/j.solener.2019.01.003)
57. Role of Selenium content in selenization of inkjet printed CIGSe2 thin film solar cell, B. S. Yadav, Suhash R. Dey and **Sanjay R. Dhage***, *AIP Conference Proceedings 2082 (2019) 50001* (https://doi.org/10.1063/1.5093861)
58. Pulsed laser annealing of spray casted Cu(In,Ga)Se2 nanocrystal thin films for solar cell application, Amol C. Badgujar, R. O. Dusane and **Sanjay R. Dhage***, *Solar Energy 199 (2020) 47-54* (https://doi.org/10.1016/j.solener.2020.02.023)
59. Microstructural investigation of inkjet printed Cu(In,Ga)Se2 thin film solar cell with improved efficiency, B. S. Yadav, K. Suresh, Suhash R. Dey and **Sanjay R. Dhage***, *Journal of alloys and Compounds 827 (2020) 154395* (https://doi.org/10.1016/j.jallcom.2020.154295)
60. Effect of annealing time and heat flux on solvothermal synthesis of CIGS nanoparticles, K. Madhuri, P.K. Kannan, Sushmita Chaudhari, **Sanjay R. Dhage** and Suhash R. Dey, *Materials Today: Proceedings 21(4) (2020) 1882-1887* (https://doi.org/10.1016/j.matpr.2020.01.245)
61. Chapter: Sustainable photovoltaics, Ginley D.,…..**Dhage S**. et al in Ginley D., Chattopadhyay K. (eds) *Volume 39, Pages 25-85, Springer Cham (2020) ISBN 978-3-030-33183-2, Online ISBN 978-3-030-33184-9* (https://doi.org/10.1007/978-3-030-33184-9_2)
62. Cu(In,Ga)Se2 thin film solar cells produced by atmospheric selenization of spray casted nanocrystalline layers, Amol C. Badgujar, R. O. Dusane and **Sanjay R. Dhage***, *Solar Energy 209 (2020) 1-10* (https://doi.org/10.1016/j.solener.2020.08.080)
63. Investigation on effect of precursor pre-heat treatment on CIGS formation using spin coated CIG precursor, K. Madhuri, P.K. Kannan, Brijesh Singh Yadav, Sushmita Chaudhari, **Sanjay R. Dhage** and Suhash R. Dey, *Journal of Materials Science: Materials in Electronics 32 (2021) 1521– 1527* (https://doi.org/10.1007/s10854-020-04921-3)
64. 12.95% efficient Cu(In,Ga)Se$_2$ solar cells by single step atmospheric selenization, scaled to monolithically integrated modules, **Sanjay R. Dhage***, Brijesh Singh Yadav, Golu Kumar Jha and Amol C. Badgujar, *ACS Applied Energy Materials 4, 1 (2021)286-294* (https://dx.doi.org/10.1021/acsaem.0c02254)
65. Inkjet printed CuInXGa(1-X) Se2 thin film by controlled selenium distribution for improved power conversion efficiency in chalcopyrite solar cells, B. S. Yadav, Suhash R. Dey and **Sanjay R. Dhage***, *Applied Surface Science Advances 6 (2021) 100144* (http://doi.org/10.1007/s10854-020-04921-3)

66. Room temperature sputtered Al doped ZnO thin film transparent electrode for application in solar cells and low bandgap optoelectronic devices, Amol C. Badgujar, Brijesh Singh Yadav, Golu Kumar Jha, **Sanjay R. Dhage***, *Materials for Renewable and Sustainable Energy (2021)* (Under Review)
67. Solution processed CdS nanostructured thing films with improved optoelectronic properties, Ravi Mudike, Prassnna Shivaramu, **Sanjay R. Dhage** and Dinesh Rangappa, *Superlattice and Microstructures (2021)* Under Review)

Invited talks/Presentations

1. Overview and challenges of thin film solar cell technologies (Invited talk) as expert resource person in the AICTE-ICTE sponsored refresher program on Recent Development in Advance Materials Phase-1 organized by *G.H. Raisoni College of Engineering, Pune* during 01-06 March 2021
2. Materials challenge of CIGS thin film solar cell technology (Invited talk) *International Conference on Smart Materials and Nanotechnology (ICSMN-2020)* January 02-04, 2020
3. Solar Energy Materials and Solar Cells (invited talk) as expert resource person in *Refresher Course in Materials Science, UGC-HRDC, Osmania University Hyderabad,* November 2019
4. Thin film solar cells (invited talk) as expert resource person in *One-week interdisciplinary AICTE QIP FDP on 'Solar Energy Harvensting" March 27-31, 2018* at Shri Guru Gobind Singhaji Institute of Engineering and Technology, Nanded 431606
5. *Solar Energy: Thin Film Solar Cells* (invited talk) January 32, 2018, Milind College of Science, Aurangabad 431001
6. Pulsed nanosecond laser scribing of bilayer Molybdenum back contact for CIGS thin film solar cell application, (Oral Presentation) *International Conference on Application of Lasers in Manufacturing September 9-11, 2015, New Delhi*
7. ARCI's research and technology demonstration initiatives for sole energy applications (Invited talk), *Research directions in Solar Energy-2014, April 1-2, 2014, Indian Institute of Science, Bangalore*
8. Environmentally Benign, Low-Cost Manufacturing of CIGS Thin Film based Solar Cells for Power Laminate application (Invited talk), *January 23 2010, ARCI, PO Balapur Hyderabad-500005*
9. Solar Cells: Future Energy for Environment (Invited talk), *15 January 2010, Arts Science and Commerce College Chandrapur, Maharashtra*
10. Review: Preparation of solar grade Silicon, (Invited talk) *May 11, 2007, New and Renewable Energy Materials Development Center (NewREC), Chonbuk National University South Korea.*
11. Environmentally benign low cost manufacturing of CIGS thin film base solar cells, (Oral presentation) *Annual Technology Conference, The 19th Korean-American scientist and engineer's association south west region University of California Irvine, USA February 2009*
12. Co-precipitation technique for the preparation of nanocrystalline ferroelectric $SrBi_2Nb_2O_9$ (Oral presentation) *Solid State Physics Symposium Guru Nanak Dev University, Amritsar India, December 2004*
13. S.R. Dhage and V. Ravi, Non-linear current-voltage characteristics of SnO_2 varistor (Oral presentation), *National seminar on Engineering Trends in Materials for Electrical Electronic and Magnetic Application,* Pune India, *November 2003*