

CURRICULUM VITAE



Dr. Bankim Chandra Ray

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<http://scholar.google.com/citations?user=EktWXksAAAAJ&hl=en>

Biosketch

Dr Bankim Chandra Ray is a Professor of the Department of Metallurgical and Materials Engineering at National Institute of Technology, Rourkela, India. Prof. Ray's research centers on the impact of extreme environmental conditions in FRP composites. He is at present pursuing the mechanistic origin of environmental damage phenomena of the engineered FRP materials. He has also worked on non-destructive evaluation of FRP materials during his academic visit to UK University. Professor Ray intends to further his expertise in the field of polymer nano-composites. He and his group have started an investigation on the effect of ultra-low temperatures on synthesis of nano-particles by sono-electro-chemical principle. He has also worked on solidification behaviour and structure-property relationship of especially Al-Si alloys. He is also investigating micro-examinations of interfaces and its implications on nano-composites in metal matrix systems. He has an experience on computer modelling of phase transformation of ferrous materials. His recent investigations have emphasized the role of carbon nanotube on the low temperature performance of FRP nano-composites. Dr. Ray has recently been selected by UNESCO based on Science Citation Index. He is the author of more than 125 scientific papers out of which 78 in International Journals and regular reviewer of many high impact Journals of Composites and Materials Science areas. Prof. Ray's research has been funded by different governmental agencies. Further, he has 25 years of teaching experience in one of the premier institute of the nation.

*Mentoring as a Project leader of multi-crores integrated Research and Development proposal for the setting-up of **Steel Technology Centre** at National Institute of Technology, Rourkela. (To be submitted soon to Ministry of Steels, GOI)*

Date of Birth: 23rd May 1963

Professional Qualifications

Ph. D.	Indian Institute of Technology, Kharagpur, India (1993)
M.Tech	Indian Institute of Technology, Kharagpur, India (1988)
B.E. (Metallurgy)	Jadavpur University, Calcutta, India (1986)

Research Interests

- FRP Composites,
- Mechanical Behaviour, Heat Treatments,
- Phase Transformations, Thin films
- Metal Joinings and Nano Science and Technology

Patents

- Ramesh Ch. Sahu, Dr. Raj Kishore Patel and **Dr. Bankim Chandra Ray**, Process for extraction of fine iron from red mud, Grant date 12/02/2013, Indian Patent no. 255321. <http://www.allindianpatents.com/patents/255321>

Scholarships

- Government of India merit Scholarship.
- Steel Authority of India merit Scholarship(Dr. B C Roy Scholarship),
- Overseas Development Agency (ODA) Fellowship (UK).

Work Experiences

More than **25** years **Teaching and Research** experience as a faculty in the Department of Metallurgical and Materials Engineering at National Institute of Technology (Deemed University), Rourkela, India.

- Lecturer (June 1989 to January 1995),
- Senior Lecturer (February 1995 to May 2002),
- Assistant Professor (June 2002 to June 2006) and
- Professor (July 2006 to till date)
- Head of the Department (July 2011- June 2014)

Overseas Experiences

- **6-months** Research and Training experience at **Sheffield Hallam University, UK (1997)**.
- One week Training Programme in **Shimdu, Singapore. 2007**.
- One week academic exposure to Mauritius (**University of Mauritius**), 2010.
- One week academic assignment to New Zealand (**University of Auckland**) 2011.

- One week academic programme in **Singapore** 2011.
- One week academic programme in **Instron USA** 2013.

Sponsored Projects

1. Feasibility study of advanced FRP composites for modern Indian structural applications, TATA steel funded INAE project. (Ongoing; December 2016- March 2017).
2. Environmental durability studies of carbon nanotube embedded fibrous polymeric composites, CSIR, 2015. (Submitted)
3. Effects of CNT addition in FRP composites on marine environmental durability, NRB, DRDO, 2015. (Ongoing; 2016-2019).
4. The effect of shock wave, moisture and sea water on de-bonding of multilayer in FRP composite systems- Experimental and multi-scale modelling based investigation, NRB, DRDO, (Ongoing; 2015-2018).
5. A ₹ 1.75 crore project under Fund for Improvement of Science & Technology Infrastructure in Universities and Higher Educational Institutions (FIST) Program-2014 from Department of Science & Technology (DST), Ministry of Science & Technology, Government of India.
6. Prodding the magnetic behaviour of sono-electroplated nano-structured Co/Cu and Ni/Cu alloy thin films by scanning probes, CSIR, 2013.
7. Assessment of Mechanical behavior of CFRP and GFRP at different hygrothermal environments, DRDO, ADE, 2012.
8. Analysis and manipulation of structures and properties of sono-electrochemically deposited nano-structured metallic thin films synthesized at low bath temperatures, DST.
9. Failure assessment of FRP composite materials at low and high temperatures under different loading speeds, CSIR (2596/NS-EMR II) 2012.
10. Characterization of interfacial chemistry and integrity of fiber/polymer composites at different loading rates and temperatures: An emphasis on failure modes, DST (Submitted SR/S3/ME/0020/2010).
11. Utilization of materials after extraction from red mud, Vedanta Aluminum 2010.
12. Pilot plant study of extraction of fine iron from red mud, Vedanta Aluminum 2010.
13. Parametric Instability of woven fiber composite panels, DST, 2008.
14. Inerting red-mud through cost-effective methods and its utilization, CSIR. 2007,
15. Preparation and characterization of SiO₂ and TiO₂ hollow nanospheres in reverse microemulsion system, DST (NSTI), 2007.
16. Thermal shocks on polymerization and de-polymerization of polymer composites (Completed) Ministry of Human Resources and Development, Government of India. 2004.
17. Effects of mixed mode overload on mode-I fatigue crack (Completed) Council of Scientific and Industrial Research, Government of India, 2004.
18. Study of wear behaviour of firm implements in soil slurry and its control, MHRD, Government of India (Completed) 2002.

Consultancy Work

- Development of new materials especially polymeric composites for Laptop base structure and thermal management (HCL, Bangalore) To be finalized (Enclosed letter and proposal)
- Invited to deliver the technological advantages for switching over from steel components to FRP composites (Ashok Leyland, Chennai) to be finalized (Enclosed letter of invitation).
- Product upgradation and quality control of tooth points J K Steels, Asansol.
- Development and upgradation of steel shots, Utkal ferro Alloys, Rourkela.
- Time to time sharing of knowledge to Rourkela Steel Plants.

Editorial Board Member of

- Journal of Advanced Research in Manufacturing, Material Science & Metallurgical Engineering (Editor in chief)
- Journal of Materials and Metallurgical Engineering
- The scientific world Journals (Materials Science)
- Journal of polymer and composites
- Advisory Board member of STM Journals
- Advisory Board member of ADR Journals

Regular reviewer of

- A) Composites Part A: Applied Science and Manufacturing (Elsevier)
- B) Journal of Applied Polymer Science (Wiley)
- C) Journal of Composite Materials (Sage)
- D) Journal of Materials Science (Springer)
- E) Composites Science and Technology (Elsevier)
- F) Polymer Bulletin (Springer)
- G) Chemical Engineering Journal (Elsevier)
- H) Carbon (Elsevier)
- I) Journal of Adhesion Science and Technology(Elsevier)
- J) Tata Search
- K) Bulletin of Materials Science (Springer)
- L) Journal of Reinforced Plastics and Composites(Sage)
- M) Journal of Hazardous Materials(Elsevier)
- N) Metallurgical and Materials Transaction A (Springer)
- O) Materials Science and Engineering A (Elsevier)
- P) Polymer composites (Wiley)
- Q) Water, Air and Soil pollution Springer)
- R) Tribology - Materials, Surfaces & Interfaces (Maney)

Recognitions and Achievements

1. Co-convenor and Chairman of different National level technical Conferences.
2. One Journal article was included as **Technologies that might soon impact your industry** under Materials adhesion section.
(Source: omnexus.com/resources/rdhighlights)
3. Three Journal articles were included in the **Faraday Technology Alerts** as new and innovative research.
4. Selected by **UNESCO and Australian Expert Committee for Industries** in the Asia-Pacific region based on Science Citation Index.
5. Delivered a talk on “Environmental Degradation of FRP Composites” in the Department of Materials at **Oxford University, UK** (10th June 1997).
6. Effects of thermal spikes and thermal shocks on hygrothermal behaviour of GFRP composites: **Guide of The BEST B.Tech PROJECT of the INSTITUTE- 2004.**
7. Conducted a workshop on “Mechanical Behaviour of Engineering Materials” at New Delhi and Mumbai organized by International Business Conferences (13-14 Oct., **2008, New Delhi and 15-16 Oct., 2008, Mumbai**).
8. Delivered an invited technical talk on “FRP composites: Present status and future prospect” in Metallurgical Alumni Industry Academia-2007 at Jadavpur University, Kolkata (11th **September, 2007**).
9. Delivered an invited talk on Implications of Environmental Interactions on Damage Mechanism of FRP Composites in Science and Engineering of Composite Materials at Jadavpur University, Kolkata (**7th March 2008**).
10. Delivered few invited talks in the following areas at **Jadavpur University** in School of Materials Science and Nanotechnology (**8th December, 2008**);
 - i) Implication of Environmental and Experimental Variations on Composite Materials.
 - ii) Modern Trends in Fiber/Polymer Interface Characterization and A Brief of Polymer Nanocomposites.
11. Delivered an invited talk on “Characterization of Interfacial Chemistry and an Assessment of Failure Behaviour of FRP Composites” in National Seminar on Deformation, Wear and Fracture-2010 (24-25 March 2010) at Jadavpur University, Kolkata.
12. Delivered a series of lectures on Environmental Degradation of Composites and mechanical Behaviour and Damage Assessment of FRP Composites at Indian Railways’ Institute of Mechanical and Electrical Engineering, Jamalpur on 11/03.10.
13. Delivered keynote lecture on” Environmental Durability of FRP Composites” at National Seminar on Composites: Metals and Polymers organised by NIST Berhampur on 1st August 2015.

Life member of

- Indian Institute of Metals (No: 23629)-1996.
- The Institute of Engineers (India) (No: 119439)-1995.
- The Indian Institute of Chemical Engineers (No: 17738)-1998.

- The Computer Society of India (No: 00080956)-2002.
- The Indian Society of Technical Education (No: 27572)-1999.

Distinguished Chairs

- Expert committee member of UPSC, New Delhi.
- Faulty selection committee members of NITs.
- Technical project review committee of Government of Switzerland.
- An empowered board expert of DST, GOI, New Delhi.
- An expert of CSIR project review committee.

A List of international journal publications

Recently published journal articles (2014 onwards)

1. D. K. Rathore, R. K. Prusty, and **B. C. Ray**, “Mechanical, Thermo-mechanical and Creep performance of CNT embedded epoxy at elevated temperatures: An emphasis on the role of carboxyl functionalization,” *J. Appl. Polym. Sci.*, (Article in press) (DOI: 10.1002/app.44851).
2. R. K. Prusty, S. K. Ghosh, D. K. Rathore, and **B. C. Ray**, “Reinforcement effect of graphene oxide in glass fiber/epoxy composites at in-situ elevated temperature environments: An emphasis on graphene oxide content,” *Compos. Part Appl. Sci. Manuf.* (In press, DOI: dx.doi.org/10.1016/j.compositesa.2017.01.001).
3. R. K. Prusty, D. K. Rathore, and **B. C. Ray**, “CNT/polymer interface in polymeric composites and its sensitivity study at different environments,” *Adv. Colloid Interface Sci.* (In press, DOI: dx.doi.org/10.1016/j.cis.2016.12.008).
4. D. K. Rathore, R. K. Prusty, S. C. Mohanty, B. P. Singh, and **B. C. Ray**, “In-situ elevated temperature flexural and creep response of inter-ply glass/carbon hybrid FRP composites,” *Mech. Mater.*, vol. 105, pp. 99–111, Feb. 2017.
5. K. K. Mahato, K. Dutta, and **B. C. Ray**, “High-temperature tensile behavior at different crosshead speeds during loading of glass fiber-reinforced polymer composites,” *J. Appl. Polym. Sci.*, vol. 134, pp. 44715.
6. K. K. Mahato, D. K. Rathore, K. Dutta, and **B. C. Ray**, “Effect of loading rates of severely thermal-shocked glass fiber/epoxy composites,” *Compos. Commun.*, vol. 3, pp. 7–10, Mar. 2017.
7. D. K. Rathore, B. P. Singh, S. C. Mohanty, R. K. Prusty, and **B. C. Ray**, “Temperature dependent reinforcement efficiency of carbon nanotube in polymer composite,” *Compos. Commun* vol. 1, pp. 29–32, Oct. 2016.
8. R. K. Prusty, D. K. Rathore, B. P. Singh, S. C. Mohanty, K. K. Mahato, and **B. C. Ray**, “Experimental optimization of flexural behaviour through inter-ply fibre hybridization in FRP composite,” *Constr. Build. Mater.*, vol. 118, pp. 327–336, Aug. 2016.

9. D K Rathore, R K Prusty, D S Kumar, **B C Ray**, Mechanical performance of CNT-filled glass fiber/epoxy composite in in-situ elevated temperature environments emphasizing the role of CNT content, *Composite Part A*, 84, 2016, 364-376.
10. R. K. Nayak, K. K. Mahato, and **B. C. Ray**, "Water Absorption Behavior, Mechanical and Thermal Properties of NanoTiO₂ Enhanced Glass Fiber Reinforced Polymer Composites," *Compos. Part Appl. Sci. Manuf.* (dx.doi.org/10.1016/j.compositesa.2016.09.003)
11. R. K. Nayak, K. K. Mahato, B. C. Routara, and **B. C. Ray**, "Evaluation of mechanical properties of Al₂O₃ and TiO₂ nano filled enhanced glass fiber reinforced polymer composites," *J. Appl. Polym. Sci.*, vol. 133, no. 47, Dec. 2016.
12. R. K. Nayak, D. Rathore, B. C. Routara, and **B. C. Ray**, "Effect of nano Al₂O₃ fillers and cross head velocity on interlaminar shear strength of glass fiber reinforced polymer composite," *Int. J. Plast. Technol.*, pp. 1–11, Aug. 2016.
13. A. K. S. Bankoti, A. K. Mondal, H. Dieringa, **B. C. Ray**, and S. Kumar, "Impression creep behaviour of squeeze-cast Ca and Sb added AZ91 magnesium alloy," *Mater. Sci. Eng. A*, vol. 673, pp. 332–345, Sep. 2016.
14. K Dash, **B C Ray**, Implications of Degree of Thermal Shocks on Flexural Properties of Cu-Al₂O₃ Micro- and Nano-composites, *Journal of Engineering Materials and Performances*, 25 (1), 2016, 259-266.
15. K Dash, S Sukumaran, **B C Ray**, The behaviour of aluminium matrix composites under thermal stresses, *Science and Engineering of Composite Materials*, 23 (1), 2016, 1-20.
16. M J Shukla, D S Kumar, D K Rathore, R K Prusty, **B C Ray**, An assessment of flexural performance of liquid nitrogen conditioned glass/epoxy composites with multiwalled carbon nanotube, *Journal of Composite Materials*. (Article in press, doi: 10.1177/0021998315615648).
17. S Sethi, **B C Ray**, Environmental effects on fibre reinforced polymeric composites: Evolving reasons and remarks on interfacial strength and stability, *Advances in Colloid and Interface Science* 217, 2015, 43–67.
18. R K Prusty, D K Rathore, M J Shukla, **B C Ray**, Flexural behaviour of CNT-filled glass/epoxy composites in an in-situ environment emphasizing temperature variation, *Composites Part: B*, 83, 2015, 166-174.
19. A.K.S. Bankoti, A.K. Mondal, Subodh Kumar, **B.C. Ray**, Individual and combined additions of calcium and antimony on microstructure and mechanical properties of squeeze-cast AZ91D magnesium alloy, *Materials Science and Engineering: A*, 626, 2015, 186–194.
20. K dash, D Chaira, **B C Ray**, Microstructural evolution and sliding wear studies of copper-alumina micro- and nano-composites fabricated by spark plasma sintering, *Journal of the Mechanical Behavior of Materials*, 24 (1-2), 2015, 25-34.
21. S Sethi, D K Rathore, **B C Ray**, Effects of temperature and loading speed on interface-dominated strength in fibre/polymer composites: An evaluation for in-situ environment, *Materials and Design*, 65, 2014, 617-626.

22. S Sethi, **B C Ray**, Experimental study on the mechanical behavior and microstructural assessment of Kevlar/epoxy composites at liquid nitrogen temperature, *Journal of the Mechanical Behavior of Materials*, 23 (3-4), 2014, 95-100.
23. **B C Ray** and D Rathore, Durability and integrity studies of environmentally conditioned interfaces in fibrous polymeric composites: Critical concepts and comments, *Advances in Colloid and Interface Science*, 209, 2014, 68-83.
24. **B C Ray** and D Rathore, Environmental damage and degradation of FRP composites: A review report, *Polymer Composites*, 36 (3), 2015, 410-423.
25. K Dash, S Panda and **B C Ray**, Effect of thermal and Cryogenic conditioning on flexural behavior of thermally shocked Cu-Al₂O₃ micro- and nano-composites, *Metallurgical and Materials Transactions: A* 45A 2014, 1567-1578.
26. K Dash, S Sukumaran, **B C Ray**, Effect of Loading Speed on Deformation of Composite Materials: A Critical Review, *Journal of Advanced Research in Manufacturing, Material Science & Metallurgical Engineering*, 1 (1), 2014, 1-29.
27. S Mishra, D K Rathore and **B C Ray**, Recent understanding on theories of moisture ingress and its effect on FRP composites, *Journal of Advanced Research in Manufacturing, Material Science & Metallurgical Engineering*, 1 (1), 2014, 29-52.
28. S Sethi, **B C Ray**, An assessment of mechanical behavior and fractography study of glass/epoxy composites at different temperatures and loading speeds, *Materials and Design*, 64, 2014, 160-165.
29. S Sethi, **B C Ray**, A study on fiber/matrix contour and interface/interphase integrity by SEM and AFM techniques, *Microscopy and Analysis*, 28 (5), 2014, 7-10.
30. S Panda, K Dash, **B C Ray**, Processing and properties of Cu based micro- and nano-composites, *Bulletin of Materials Science*, 37 (2), 2014, 227-238.
31. **B C Ray**, D Rathore, A Review on Mechanical Behavior of FRP Composites at Different Loading Speeds, *Critical Reviews in Solid State and Material Science*, 40 (2), 2015, 119-135.
32. R K Prusty, D K Rathore, **B C Ray**, Assessment and modification strategies for improved interlaminar properties of advanced FRP composites: A review, *Journal of Advanced Research in Manufacturing, Material Science & Metallurgical Engineering*, 1 (2), 2014, 1-25.
33. K K Mahato, M J Shukla, D S Kumar, **B C Ray**, In-service Performance of Fiber Reinforced Polymer Composite in Different Environmental Conditions: A Review, *Journal of Advanced Research in Manufacturing, Material Science & Metallurgical Engineering*, 1 (2), 2014, 55-88.

Articles under process

1. D.K. Rathore, R.K. Prusty, **B.C. Ray**, Temperature dependent interfacial adhesion and its subsequent effect on mechanical performance of carbon nanofiber/epoxy nanocomposite, *J. Compos. Mater.* (Under review, Manuscript ID: JCM-16-0504).
2. R.K. Prusty, D.K. Rathore, **B.C. Ray**, Evaluation of the role of functionalized CNT in glass fiber/epoxy composite at above- and sub- zero temperatures: Emphasizing

interfacial microstructures, *Compos. Part Appl. Sci. Manuf.*, (Under review, Manuscript ID: JCOMA-16-2098).

3. P.N. Harshita, D.K. Rathore, R.K. Prusty, **B.C. Ray**, Extrapolation of mechanical strengthening effect in nanoclay/epoxy nanocomposites to elevated temperature environments, *Bull. Mater. Sci.* (Under review, Manuscript ID:BOMS-D-16-01098)
4. R.K. Prusty, D.K. Rathore, S. Sahoo, V. Parida, **B.C. Ray**, Mechanical behaviour of graphene oxide embedded epoxy nanocomposite at sub- and above- zero temperature environments, *Compos. Commun.* (Revision submitted, Manuscript ID:COCO-2016-76).

Past publications

1. S Sethi and **B C Ray**, Effect of Nanoparticle in FRP Composites on Evaluation of Loading Rate Sensitivity, *International Journal of Composite Materials* 3(6) 2013
2. Mallik, A, A.K. Bankoti and **B C Ray**, On the effects of bath composition and ultrasound on structures and properties of Cu thin films, *Russian Journal of Electrochemistry*, 49(2) 2013,146-152.
3. K. Dash, D. Chaira, **B.C. Ray**, Synthesis and characterization of aluminium-alumina micro- and nano-composites by spark plasma sintering, *Materials Research Bulletin*, 48 (2) 2013, 2535-2542.
4. Dash, K, Panda, S and **Ray, B. C.** Process and progress of sintering behavior of Cu-Al₂O₃ composites. *Emerging Materials Research*, 1 (1) (2013), 32–38.
5. S.Sethi, **B.C.Ray**, An assessment of interfacial chemistry and character of fiber/polymer micro-composites, *Journal of Materials & Metallurgical Engineering*, 3(1) 2013.
6. Gupta, S, Dash, K, **Ray, B. C.**, Analysis of Properties of Copper-Alumina Composites Produced by Various Processing Routes: A Review, *Journal of Materials & Metallurgical Engineering*, 2(3) 2012, 11-23.
7. S.Sethi, P K Panda, R Nayak and **B. C. Ray**, Experimental studies on mechanical behavior and microstructural assessment of glass/epoxy composites at low temperatures *Journal of Reinforced Plastics and Composites*, 31(2) (2012) 67-76.
8. K. Dash, **B. C. Ray** and D Chaira, Synthesis and characterization of copper-alumina metal matrix composite by conventional and spark plasma sintering, *J. alloys and Compounds*,516(2012) 78-84.
9. A. Das, A. Mallik and **B. C. Ray**, Analysis of Effect of Ultrasound on the Magnetic Topography of Electroplated Ni Films by Magnetic Force Microscopy (MFM), *Metallurgical and Materials Transactions:B*, 43 (2) 2012, 267-275.
10. R C Sahu, R K Patel and **B. C. Ray**, Removal of hydrogen sulfide using red mud at ambient conditions, *Fuel Processing Technology*, 92(8) (2011) 1587-92.
11. Mallik, A. and **B. C. Ray**, An analysis of the temperature-induced supersaturation effects on structure and properties of sono-electrodeposited copper thin films, *Surface and Coating Technology*, 206(7) (2011) 1947-54.
12. S Sethi and **B C Ray**, Evaluation of structural integrity and mechanical behavior of advanced FRP composites, *Int. J. of Structural Integrity*, 2(2) 2011.
13. Mallik, A., and **B. C. Ray**, Evolution of principle and practice of electrodeposited thin film: A review on effect of temperature and sonication, *International Journal of Electrochemistry*, 2011(2011).

14. Mallik, A. and **B. C. Ray**, Residual stress and nano-mechanical properties of sonoelectro deposited Cu films, *Surface Engineering*, 27(7) (2011) 551-556.
15. Sahu, R C, Patel, R K, **Ray, B. C.**, Adsorption of Zn(II) on activated red mud: Neutralized by CO₂, *Desalination*, 266 (2011) 93–97.
16. R C Sahu, R K Patel and **B. C. Ray**, Utilization of activated CO₂-neutralized red mud for removal of Arsenate from aqueous solutions, *Journal of Hazardous Materials*, 179 (2010), 1007-1013.
17. R C Sahu, R K Patel and **B. C. Ray**, Neutralization of red mud using CO₂ sequestration cycle *Journal of Hazardous Materials*, 179 (2010), 28–34.
18. G. Mishra, S. R. Mohapatra, P. R. Behera, B. Dash, U.K. Mohanty and **B.C.Ray** Environmental stability of GFRP laminated composites: An emphasis on mechanical behavior *Aircraft Engineering and Aerospace Technology*, 82 (4) 2010, 258-66.
19. Mallik A., A. Bankoti and **B. C. Ray**, Study on the Modification of Conventional Electrochemical Crystallization under Sonication: The Phenomena of Secondary Nucleation, *Electrochemical and Solid-State Letters*, 12 (12) 2009, F46-F49.
20. Mallik, A., and **B. C. Ray**, Morphological study of electrodeposited copper under the influence of ultrasound and low temperature, *Thin Solid Film*, 517 2009, 6612-6616.
21. N Sharma, M K Surendra and **B. C. Ray**, Study the Effect of Hygrothermal Ageing on Glass/Epoxy Micro-composites by FTIR Imaging and Alternating DSC Techniques, *Journal of Reinforced Plastics and Composites* 27(15) 2008 1625-1634.
22. M K Surendra, N Sharma and **B. C. Ray**, Mechanical Behavior of Glass/Epoxy Composites at Liquid Nitrogen Temperature, *Journal of Reinforced Plastics and Composites* 27(9) 2008 937-944.
23. B Das, S K Sahu and **B. C. Ray**, Effect of Loading Speed on the Failure Behavior of FRP Composites, *Aircraft Engineering and Aerospace Technology*, 79(1) 2007, 45-52.
24. **B.C. Ray**, S T Hasan and D W Clegg; Evaluation of Defects in FRP Composites by NDT Techniques, *Journal of Reinforced Plastics and Composites* 26(12) 2007, 1187-1192.
25. Surendra Kumar M, Nirmal Chawla, Asima Priyadarsini, Itishree Mishra and **B. C. Ray**, Assessment of Microstructural Integrity of Glass/Epoxy Composites at Liquid Nitrogen Temperature, *Journal of Reinforced Plastics and Composites* 26(11) 2007, 1083-1089.
26. T Bera, S.Mula, P K Ray and **B. C. Ray**; Effect of Thermal Shocks and Thermal Spikes on Hygrothermal Behavior of Glass/polyester Composites, *Journal of Reinforced Plastics and Composites* 26(7) 2007, 725-738.
27. A K Srivastava, M K Behera and **B. C. Ray**; Loading Rate Sensitivity of Jute/Glass Hybrid Reinforced Epoxy Composites: Effect of Surface Modifications, *Journal of Reinforced Plastics and Composites*, 26(9), 2007, 851-860.
28. P K Ray, S Mula, U K Mohanty and **B. C. Ray**; Effect of hygrothermal shock cycles on interlaminar strength of hybrid composites, *Journal of Reinforced Plastics and Composites* 26(5) 2007, 519-324.
29. **B C. Ray**, Effects of changing seawater temperature on mechanical properties of GRP composites, *Polymers and Polymer Composites* 15(1) 2007, 59-64.
30. **B C. Ray**; Adhesion of glass/epoxy composites influenced by thermal and cryogenic environments, *Journal of Applied Polymer Science* 102(2) 2006, 1943-1949.

31. **B. C. Ray**; Temperature effect during humid ageing on interfaces of glass and carbon fibers reinforced epoxy composites, *Journal of Colloid and Interface Science* 298(1) 2006, 111-117. (96 citations)
32. **B. C. Ray**; Effects of changing environment and loading speed on mechanical behavior of FRP composites, *Journal of Reinforced Plastics and Composites* 25(12) 2006, 1227-1240.
33. **B. C. Ray**; Loading rate effects on mechanical properties of polymer composites at Ultra-low Temperatures, *Journal of Applied Polymer Science* 100(3) 2006, 2289-2292.
34. **B. C. Ray**; Effect of thermal shock on interlaminar strength of thermally aged glass fiber reinforced epoxy composites, *Journal of Applied Polymer Science* 100(3) 2006, 2062-2066.
35. **B. C. Ray**; Effect of thermal shock on flexural modulus of thermally and cryogenically conditioned Kevlar/epoxy composites, *Advanced Composites Letters* 14(2) 2005, 57-61.
36. **B. C. Ray**; Loading rate sensitivity of glass fiber-epoxy composites at ambient and sub-ambient temperatures, *Journal of Reinforced Plastics and Composites* 25(3) 2006, 329-333.
37. S Mula, T Bera, P K Ray, **B. C. Ray**; Effects of hydrothermal aging on mechanical behaviour of sub-zero weathered GFRP composites, *Journal of Reinforced Plastics and Composites* 25(6) (2006) 673-80.
38. **B. C. Ray**, S Mula, T Bera, P K Ray; Prior thermal spikes and thermal shocks on mechanical behavior of glass-epoxy composites, *Journal of Reinforced Plastics and Composites* 25(2)2006, 197-213.
39. **B. C. Ray**, B B Verma, U K Mohanty; Influence of crucible Rotation Speed on hardness, Cast structure and Impact Properties, *Transactions of Indian Institute of Metals*, 59(1), 2006,57-63.
40. **B. C. Ray**; Freeze-thaw response of glass-polyester composites at different loading rates, *Journal of Reinforced Plastics and Composites* 24(16) 2005, 1771-1776.
41. **B. C. Ray**; Effect of hydrothermal shock cycles on shear strength of glass fiber-polyester composites, *Journal of Reinforced Plastics and Composites* 24(12) 2005, 1335-1340.
42. **B. C. Ray**; Hydrothermal fatigue on interface of glass-epoxy laminates, *Journal of Reinforced Plastics and Composites*, 24(10) 2005, 1051-1056.
43. **B. C. Ray**; Effects of thermal and cryogenic conditionings on mechanical behavior of thermally shocked glass fiber-epoxy composites, *Journal of Reinforced Plastics and Composites* 24(7) 2005, 713-717.
44. **B. C. Ray**; Thermal shock and thermal fatigue on delamination of glass fiber reinforced polymer composites, *Journal of Reinforced Plastics and Composites*, 24(1) 2005, 111-116.
45. **B. C. Ray**; Effects of crosshead velocity and sub-zero temperature on mechanical behaviour of hygrothermally conditioned glass fibre reinforced epoxy composites, *Materials Science and Engineering A* 379(1-2) 2004,39-44.
46. **B. C. Ray**; Thermal shock on interfacial adhesion of thermally conditioned glass/epoxy composites, *Materials Letters* 58(16) 2004, 2175-2177.
47. **B. C. Ray**; Study of the influence of thermal shock on interfacial damage in thermosetting matrix aramid fibre composites, *Journal of Materials Science Letters* 22 (3) 2003 201-202.

48. **B. C. Ray**, S T Hasan & D W Clegg; Effects of thermal shock on modulus of thermally and cryogenically conditioned Kevlar/polyester composites, *Journal of Materials Science Letters* 22(3)2003, 203-204.
49. **B. C. Ray**; Assessment of mechanical behaviour of Kevlar/polyester composites after thermal shock conditioning, *Journal of Materials Science Letters* 21(18) 2002, 1391-1392.
50. Surendra Kumar, M Sharma, Neeti **B. C. Ray**, Structural Integrity of Glass/Polyester Composites at Liquid Nitrogen Temperature *Journal of Reinforced Plastics and Composites*, 28 (11) 2009 1297-1304.
51. Surendra Kumar, M Sharma, Neeti **B. C. Ray**, Microstructural and Mechanical Aspects of Carbon/Epoxy Composites at Liquid Nitrogen Temperature *Journal of Reinforced Plastics and Composites*, 28(16) 2009 2013-2023.
52. **B. C. Ray**, A Biswas & P K Sinha ;Freezing and thermal spikes effects on ILSS values of hygrothermally conditioned glass fibre/epoxy composites, *J. Mater. Sci. Lett.* 11 (1992) 508.
53. P Basak, **B. C. Ray** & I. chakraborty; The effect of rotation on the eutectic phase in hypoeutectic Al-Si alloy, *J. Mater. Sc. Lett.* 10 (1991) 313.
54. S. Kar, **B. C. Ray** & P Basak; Recovery of Cu-Ni alloy from Ni-rich anode slag, *Trans. Indian Inst. Met.* 43, 4 (1990) 218.
55. **B. C. Ray**, A Biswas & P K Sinha: Hygrothermal effects on the mechanical behaviour of fibre-reinforced polymeric composites, *Metal Materials and Processes*, 3, 2 (1991), 99.

Conference Proceedings

01. S C Mohanty, B P Singh, K K Mahato, D K Rathore, R K Prusty and **B C Ray**, Water absorption behavior and residual strength assessment of glass/epoxy and glass-carbon/epoxy hybrid composite, *IOP Conf. Series: Materials Science and Engineering* 115, (2016), 012029.
02. K K Mahato, M Biswal, D K Rathore, R K Prusty, K Dutta and **B C Ray**, Effect of loading rate on tensile properties and failure behavior of glass fibre/epoxy composite, *IOP Conf. Series: Materials Science and Engineering* 115, (2016), 012017.
03. M J Shukla, D S Kumar, K K Mahato, D K Rathore, R K Prusty and **B C Ray**, A comparative study of the mechanical performance of Glass and Glass/Carbon hybrid polymer composites at different temperature environments, *IOP Conf. Series: Materials Science and Engineering* 75 (2015) 012002.
04. D S Kumar, M J Shukla, K K Mahato, D K Rathore, R K Prusty and **B C Ray**, Effect of post-curing on thermal and mechanical behavior of GFRP composites, *IOP Conf. Series: Materials Science and Engineering* 75 (2015) 012012.
05. M S Kumar and B C Ray, Mechanical Behavior of FRP Composites at Low Temperature, *International Conf. on Recent Advances in Composite Materials*, ND, Allied Publishers Pvt. Ltd. (2007) 268-274.
06. **B C Ray**, A Biswas & P K Sinha; On the evaluation of interlaminar shear – a critical design parameter, *Proceedings on Sci. and Tech. Composites, Adhesives and Sealants*, Bangalore, India (Sept.' 89) 321-325.
07. **B C Ray**, S T Hasan & D W Clegg; Effects of thermal shock on mechanical behavior of Kevlar fibre composites, *National Seminar on Composite Materials*, (March, 1998), Proc. 214-223.

08. **B C Ray**, A Biswas & P K Sinha; Characterization of hygrothermal diffusion parameters in fibre-reinforced polymeric composites, Proceedings on Aircraft Propulsion, Mesra, India (**Jan.89**) S-22.
09. **B C Ray**; Environmental degradation of FRP composites, International Conference on Advances in Materials and Materials Processing (**Feb.2002**) Tata-MacGraw-hill, ND181-184.
10. A. Pradhan, R.N. Lal, B. Sahu, A.K. Panda and **B C Ray**, Degradative effect of environmental Parameters on fiber reinforced composites, CHEMCON-2003, Bhubaneswar, December-2003.
11. P.K. Mishra and **B C Ray**, Effect of thermal shock on interfacial behavior of glass fiber reinforced epoxy laminates, CHEMCON-2003, Bhubaneswar, December-2003.
12. P K Ray, A. Bhusan, T Bera, R Ranjan, U Mohanty, S Vadhera and **B C Ray**; Mechanical behavior of hygrothermally conditioned FRP composites after thermal spikes, Emerging
13. Trends in Structural mechanics and Composites, **2003**, November 1-2, NIT Rourkela 322-332.

International Conferences

- S C Mohanty, D K Rathore, B P Singh, R K Prusty, **B C Ray**, Effect of post-mixing vacuum degassing time of MWCNT/epoxy mixture and MWCNT content on the flexural behaviour of MWCNT filled glass/epoxy composite, International Conference on Nanostructured Polymeric Materials and Polymer Nanocomposites, held at Mahatma Gandhi University, Kottayam, during 13-15 November 2015.
- B P Singh, D K Rathore, S C Mohanty, R K Prusty, **B C Ray**, In-situ elevated temperature mechanical performance of MWCNT/epoxy nanocomposite, International Conference on Nanostructured Polymeric Materials and Polymer Nanocomposites, held at Mahatma Gandhi University, Kottayam, during 13-15 November 2015.
- D K Rathore, S Sethi, **B C Ray**, Implications of temperature and loading rate on mechanical performance of glass fiber reinforced polymer composites, Presented at International Union of Materials Research Society- International Conference in Asia - 2013 (IUMRS-ICA 2013), held at Indian Institute of Science, Bangalore, 16-20 December 2013.
- **Ray, B.C.**, S.Sethi, An evaluation of the failure behavior with changing loading rate in E-glass fiber/epoxy composites at low temperatures. Designing composite materials: Avoiding large structural failures, An International Conference: DFC12/SI6, Queen's College, Cambridge, England from 8th-11th April 2013.
- **Ray, B.C.**, S.Sethi, Loading rate sensitivity of FRP composites; an overview- International symposium for research scholars on Metallurgy, Materials science and Engineering (ISRS), IIT Madras from 20th Dec-22nd Dec 2012.
- **Ray, B.C.**, S.Sethi, Environmental and Experimental stability of FRP composites. International Conference on Composite materials, International Centre of Goa, 13th - 16th February, 2013.
- K. Dash, **B C Ray** and D Chaira, A Comparative study of Al-Al₂O₃ Micro- and Nanocomposites Prepared by Powder Metallurgy Route, presented at International

Conference on Nanoscience and Technology (ICNT 2012), Sorbonne University, Paris, France.

- **B.C.Ray**, An investigation on loading rate sensitivity of environmentally fatigued fibrous composites, International conference on Materials for advanced technologies (ICMAT-2011), 26th June to 1st July 2011, Suntec, Singapore.
- **B.C.Ray**, An Assessment on Failure Behavior of Environmentally Conditioned FRP Composites: An Emphasis on Micromechanics Understanding International conference on Materials for advanced technologies (ICMAT-2011), 26th June to 1st July 2011, Suntec, Singapore
- S.Sethi and **B C Ray**, Evaluation of Environmental Damage and Degradation Study of Fiber/Polymer Composites, 3rd International Congress of Environmental Research, September 16-18, 2010, University of Mauritius, Mauritius.
- R P Dalai, **B C Ray**, Failure and Fractography Studies of FRP Composites: Effects of Loading Speed and Environments PFAM 19 (Processing and Fabrication of Advanced Materials) , University of Auckland, New Zealand, 14-17th January, 2011
- **B C Ray**; The mechanism of **RAY's treatment** (Freezing of absorbed moisture) on degradation of FRP Composites, Int. Conf. On Interfacial Phenomena in composite materials, Cambridge (U.K.) **13 – 15 Sept.'93**.
- **B C Ray**; Environmental Influence on the decohesion of fibre/epoxy interphase; Int. Symposium on the Interphase, Williamsburg, Virginia, (U.S.A). **Feb. 21-26, 1993**.
- **B C Ray**; Strength Properties of Polymer composites under hygrothermal environments; Int. Conf. On Advanced composites, University of Wollongong, (Australia) **Feb. 15-19, 1993**.
- **B C Ray**; Environmental Influence on the decohesion of fibre/epoxy interphase; Int. Symposium on the Interphase, Williamsburg, Virginia, (U.S.A). **Feb. 21-26, 1993**.
- **B C Ray**; Cryogenic temperature and thermal shock effects on interlaminar failure of kevlar-reinforced plastic composites, Int. Conf. On Fracture of polymer, composites and adhesives, Les Dlablerets, (Switzerland) **13-15 sept, 1999**.
- **B C Ray**; Strain rate effects on ILSS values of hygrothermally conditioned glass fibre/epoxy composites, Int. Conf. On Deformation and fracture of composites, Guildford, (U.K.) **March'95**.
- **B C Ray et al**; Prediction of moisture content and mechanical properties in FRP composites, Int. Conf. On Advances in composites-2000, Bangalore, (India) **24-26 Aug, 2000**.
- **B C Ray**; Influence of aqueous medium on the interfacial strength of glass/epoxy composites, Int. Conf. On Deformation and fracture of composites, Guildford, (U.K.) **March'95**.

- **B C Ray**; Environmental effects on the interlaminar shear failure of FRP composites; Int. Conf. On Deformation and fracture of Composites; Manchester (**U.K.**).
- **B C Ray**; Evaluation of interfacial adhesion of hygrothermally conditioned carbon/epoxy composites by tensile tests; TMS Annual Meeting California, (**USA**) March 2003 Submitted.
- **B C Ray**; Thermal shock at the fiber/matrix interface: An overview, Materials Congress **2004**, 30th March – 1April London (**UK**).
- **B C Ray**; Influence of aqueous solutions on mechanical behavior of GFRP composites at room temperature and at High Temperature, 11th European Conf. On Composite Materials, **2004**, May 31-June 3, Rhodes, Greece.

National Level Conferences

- S C Mohanty, B P Singh, D K Rathore, R K Prusty, **B C Ray**, Water absorption behavior and residual strength assessment of glass/epoxy and glass-carbon/epoxy hybrid composite, National Conference on Processing and Characterization of Materials (NCPCM-2015), held at National Institute of Technology, Rourkela during 12-13 December 2015.
- D.K.Rathore, S.Sethi, **B.C.Ray**, An Assessment of Temperature and Loading Rate on Interlaminar Shear Strength of Glass Fiber/Epoxy Composites, Presented at National Symposium for Material Research Scholars, MR 13, IIT Bombay.
- D K Rathore, K K Mahato and **B C Ray**, Effect of high temperature and different crosshead velocities on mechanical performance of fibrous polymeric composites. Presented at National Metallurgist's Day-ATM 2013 held at Indian Institute of Technology, Banaras Hindu University, Varanasi, 12-13, November, 2013.
- **B C Ray**, Effects of Environmental ageing on failure of polymer composites, CHEMCON 2007, December 27-30, 2007, Kolkata
- **B C Ray** et al; A study on the mechanical performance of corrosive medium treated GRP composites, Maintenance, Inspection, Corrosion Management and Plant Reliability, MICMAP-91, Baroda, India (Feb.'91).
- **B C Ray** et al; Environmental effects on mechanical behavior of glass fibre-epoxy composites, 5th National Convention of Aerospace Engineer and All India Seminar of New Materials in Aerospace, Chandigarh, India, (Feb.'90).
- **B C Ray**; Hygrothermal effects on the degradation of GRP composites, Symposium on Advances in Materials: New Materials, TAC, Madras, India (May'90).
- **B C Ray**; Variation of shear values of glass/epoxy composites in H₂SO₄ and NaCl solution; The SEM investigation, Symposium on Advances in Materials: New Materials, TAC, Madras, India, (May'90).
- **B C Ray**; Hygrothermal effects on the mechanical behavior of fibre-reinforced polymeric composites, ATM, IIM, Calcutta, India, (Nov.'90).
- **B C Ray** and A. Biswas; The mathematical modelling of continuous-cooling transformation, ATM, IIM, Calcutta (Nov.'89).

- **B C Ray**; Influence of aqueous medium on the interfacial strength of glass/epoxy composites, Int. Conf. On Deformation and fracture of composites, Guildford, U.K. (March'95).
- **B C Ray**; Failure Mechanism of FRP composites: An overview; 37th Congress of the Indian Society of Theoretical and Applied Mechanics, Pantnagar, India (Jan. 14-17, 1993).
- **B C Ray** et al; Sub-zero weathering of polymer composites; 37th Congress of ISTAM, Pantnagar, India (Jan. 14-17, 1993).
- **B C Ray**; Effect of centrifugal on the refinement of eutectic morphology for Al-9% Si alloy. ATM, IIM, Calcutta (Nov.'95).
- **B C Ray**; Hygrothermal characteristics of fibre reinforced polymer composites, CHEMCON-2002, Hyderabad, December 2002.
- **B C Ray**, S T Hasan and D W Clegg; Characterization of defects in polymer composites by NDT methods; NMD-ATM-2002 Baroda, November 2002.
- **B C Ray**, Thermal Stress on shear strength of glass fiber/epoxy composites, NMD-ATM-2003, Kolkata, November 2003.
- P.K. Ray, A .Bhusan, T. Bera, U. Mohanty, R. Ranjan, **B C Ray**, Chemistry of environmental Degradation of FRP composites, NMD-ATM-2003, Kolkata, **November** 2003.
- **B C Ray** and R. Pattanaik, Effect of thermal spike on ILSS of glass fiber/epoxy composites after ageing in water and saline at high temperature, Chemical Congress-2003, Bhubaneswar, Decmber-2003.

Books/Book chapters

Published:

- **B C Ray**, S Sethi, Mechanical Behavior of Polymer Composites at Cryogenic Temperatures. In: Polymers at Cryogenic Temperature, edited by Shusheel Kalia, Shao-Yun Fu, Springer Berlin Heidelberg, Germany 2013, Print ISBN 978-3-642-35334-5.
- S. Sahoo, **B. C. Ray**, A. Mallik, Sono-Electrodeposition of thin films: A study on effect of operating parameters on electrochemical deposition of metallic thin films in presence of ultrasound, LAP LAMBERT Academic Publishing, Germany, 2010, ISBN – 13: 978-3-8433-6265-8.
- Neeti Sharma and **B C Ray**, Assessment of small interactions at the interface of FRP composites, Paperback: 116 pages Publisher: LAP Lambert Academic Publishing (21 Sep 2009) Language English ISBN-10: 3838313933 ISBN-13: 978-3838313931.
- Ramesh Ch. Sahu, Raj Kishore Patel and **Bankim Chandra Ray**, Carbon Dioxide and Red Mud chemistry for Industrial Utilizations, Published 10/02/2012 Publisher LAP Lambert Academic Publishing AG & Co KG ISBN 9783846581360.
- Sanghamitra Sethi, **Bankim Chandra Ray**, Assessment of interfacial and mechanical behavior of FRP composites: Progress and degradation of polymer composites. Published 10/08/2012 Publisher LAP Lambert Academic Publishing AG & Co KG ISBN 9783659170409

To be published:

1. **B.C. Ray**, R K Prusty, D K Rathore, Fibrous Polymeric Composites: Environmental Degradation and Damage, **CRC Press, Taylor & Francis Group**, FL USA. (Book proposal reviewed and accepted by CRC Press, Taylor and Francis Group. Book is under preparation and likely to be published in the early 2017)
2. **B.C.Ray**, Prior Thermal Spikes and Thermal Shocks on Mechanical Behavior of Glass Fiber-epoxy Composites (Section of Encyclopedia of Thermal Stresses), **Springer Publishing House** (Book Chapter).

Subjects Taught at UG and PG Levels

UG

Phase Transformations of Materials

Physical Metallurgy of Ferrous and Non-ferrous Alloys

Heat treatments and Phase Transformations

Metal Joining and Powder Metallurgy

Composite Materials

PG

Mechanical Behavior of Materials

Experimental Techniques

Dislocation Theory

Phase Transformations and Heat Treatments

Metal Joining and Powder Metallurgy

Ph. D Supervision

Past scholars

Name of Scholar

Thesis title

Archana Mallik

Effects of temperature and ultrasound on nucleation behavior during electrochemical synthesis of Copper thin films. **(2010)**

Ramesh Chandra Sahu

Neutralization of red mud using CO₂ and their utilization. **(2011)**

Khushbu Dash	Fabrication and characterization of metal matrix composites: an emphasis on micro-and –nano particulate reinforcement. (2014)
Sanghamitra Sethi	A study on environmental degradation of FRP composites through interfacial and microstructural characterization. (2015)
Ramesh Kumar Nayak	Assessment of hydrothermal durability of nano Al ₂ O ₃ and TiO ₂ enhanced glass fiber reinforced polymer composite. (2016)
Sumanta Kumar Sahoo	Electrochemically controlled synthesis of few-layer graphene nanosheets. (Submitted)
Anil Kumar Singh Bankoti	Influence of individual and combined additions of Ca and Sb on microstructure, mechanical properties and corrosion behaviour of AZ91Mg alloy. (Submitted)
Dinesh Kumar Rathore	Flexural behaviour of nano-filler enhanced and inter-ply hybrid FRP composites at different in-situ elevated temperatures. (Submitted)

Current scholars

<i>Name of Scholar</i>	<i>Title</i>
Rajesh Kumar Prusty	Development of FRP composites for cryogenic applications. (Apr, 2014)
Kishore Kumar Mahato	Fatigue and Fracture of environmentally conditioned FRP composites. (July, 2014)
Nidhi Sharma	Fabrication and characterization of graphene/polymer nanocomposites. (July, 2014)
Savita Gupta	Numerical and experimental evaluation of mechanical behaviour of FRP composites under marine environments (July, 2016)
Pavan Kumar Gangineni	Fatigue and creep behaviour of nano-filler enhanced FRP composites (January, 2017)

M. Tech Supervision

Past students

<i>Name of student</i>	<i>Thesis title</i>
Sarat Chandra Mohanty	Development of CNT modified GFRP composites and assessment of its elevated temperature mechanical performance (2016)

Bhanu Pratap Singh	Mechanical performance evaluation of carbon nanotube reinforced polymer nanocomposites at above ambient temperature environments (2016)
Meet Jayesh Shukla	Elevated temperature performance of hybrid polymer composites (2015)
Devalingam S Kumar	A new generation FRP composite for low and cryogenic temperature applications (2015)
Suvin Sukumaran	Effect of quenching heat treatment on the mechanical properties of Al-Alumina MMCs (2014)
Kishore Kumar Mahato	An assessment of mechanical behaviour of environmentally conditioned FRP composites (2014)
Sujata Panda	A study of deformation behavior Cu-Al ₂ O ₃ metal matrix composites with the variation of size and volume fraction of reinforcement particle (2012).
A. Das	Probing magnetic properties of electrodeposited Co/Cu and Ni/Cu alloys films by scanning probes. (2010)
S. Rout	Thermodynamics and kinetics study of growth behaviour of sono-electrodeposited thin films. (2010)
R. P. Dalai	An assessment of mechanical behaviour of fibrous polymeric composites under different loading speeds at above-and sub-ambient temperature. (2010)
S. Sethi	Characterisation of interfacial integrity and its implication on mechanical behaviour of FRP composites. (2010)
A.K.S. Bankoti	Synergistic study on electrochemically deposited thin film with a spectrum from micro to nano range structure. (2009).
R. K. Sahoo	Sono-electrochemical synthesis of metallic multilayers nanocomposites and their characterization.(2008)
S. Sahoo	Effect of operating parameters on electrochemical deposition of metallic thin films in presence of ultrasound. (2008)
R. M. Chauhan	Sono-electrochemical synthesis of ultrafine Copper deposits at ambient and sub-ambient temperatures.(2007).
Neeti Sharma	Assessment of small interactions and structural gradient at the FRP composites by FTIR –imaging and DSC techniques.(2007)
S. Setty	Loading rate sensitivity of Glass, Carbon and Glass/Carbon reinforced polymer composites at low temperatures. (2006)
B. Das	Effect of strain rate on mechanical behaviour of FRP composites (2004)
D. Mahesh	Effect of environment parameters on polymerization/depolymerisation of polymers.(2004)
P. K. Mishra	Thermal cyclic on mechanical behaviour of glass fiber reinforced composites. (2003)
D. Mohanty	Interfacial degradation of FRP composites. (1995)
S .S. Panda	Mechanism of environmental degradation of FRP composites.(1994)
G.C. Patra	weathering of polymer composites.(1992)
A. Kumar	Hygrothermal effect on mechanical behaviour of glass fiber reinforced composites. (1989)

Current students

Pradeep Biswal	An investigation on moisture uptake kinetics and durability assessment of inter-ply hybrid FRP composites under hydrothermal ageing
Debraj Sahoo	Effect of CNT addition on moisture uptake behavior of glass fibre/epoxy composites under hygrothermal conditionings
Sai Seetharam	Elevated temperature creep behavior of CNT modified glass fibre/epoxy composites
Sohan Ghosh	Effects of graphene oxide on elevated temperature flexural, creep and dynamic mechanical behavior of glass fibre/epoxy composites

Research work

Post-doctoral Study (Topic: Advanced Composites, NDT Evaluation of FRP, Supervisors: Prof. D W Clegg and Dr. T K Hassan, UK)

Research was carried out on kevlar and carbon fibres reinforced polymer composites to evaluate and characterize their properties and behaviour under cryogenic temperatures and also under severe thermal shock. An effort has also been made to assess the defects of these composites by NDT techniques like thermal imaging, A-Scan and C-Scan, Ultrasonic, SEM and photo-microscopy etc.

Research at Doctoral Level (Topic: Environmental Degradation of FRP Composites, Supervisors: Prof. A Biswas and Prof. P K Sinha, IIT, Kharagpur)

The investigation was essentially an experimental one involving glass- and carbon fibre composites. The resin used was the epoxy system. One important area of the investigation concern with the absorption and desorption of moisture in these composites.

The major emphasis was laid on evaluating the interlaminar shear strength (ILSS) of laminated composites, which is the weakest structural link and forms an important design criterion. The ILSS values were found to be highly sensitive to deterioration due to such absorbed moisture. The strain rate effects on the hygrothermally conditioned ILSS specimen has also been carried out.

The work focussed in the area of effects of freezing and thermal spikes on the hygrothermally conditioned glass/epoxy composites to investigate the deleterious effect on ILSS values.

An investigation was also carried out with glass/epoxy composites to find out the behaviour of ILSS values by immersing the materials in sulphuric acid and sodium chloride solution of water.

M.Tech(Topic: Computer Modelling of Transformation Kinetics, Supervisor: Prof. A. Biswas, IIT, Kharagpur)

The kinetics of austenite-to-pearlite transformation was measured under isothermal and continuous cooling conditions on 1080 steel. The isothermal transformation kinetics was analysed in terms of Avrami Equation. The mathematical modelling was formulated to predict the progress of Austenite-to-pearlite transformation during continuous cooling. The kinetics are characterized by subdividing the cooling curve into a series of isothermal steps. The need to develop such computer model is that steel industries are rapidly adopting continuous processes includes continuous casting, continuous heat treatments to minimize process cost and to improve quality of the products. The findings revealed that there is a close proximity and a reasonably good agreement between calculated and experimental data.

Continuing Education Programmes Attended

1. Recent advances in physics of amorphous materials-Indian Institute of Technology, Kharagpur, India (1992).
 2. Principles and technology for processing of advanced materials- IIT, Kharagpur, India (1990).
 3. Art of Programming- NIT, Rourkela, India GOI, World Bank, Swiss Development Corporation (2001).
 4. Electronic materials technology-IIT, Kharagpur, India (1991).
 5. Welding technology for engineers-Sheffield Hallam University, UK (1997).
 6. Alloy cast irons- Recent development and applications- IIT, Kharagpur, India (1992).
 7. Educational technology-IIT, Delhi, India (1997).
 8. Professional standard and quality in engineering-Sheffield Hallam University, UK(1997).
 9. AGM-on Composite Materials- Nottingham University, UK (1997).
 10. Workshop on educational infrastructures- Manchester Metropolitan University, UK(1997).
 11. Course on C++ at NIT, Rourkela (2003).
-

Evaluation of Interfacial Phenomena and Damage Mechanism of FRP Composites at Different Environments and varying Loading Conditions

It is generally recognized that the bond strength variation at the fiber/matrix interfaces greatly affects the mechanical characteristics of composite materials. Due to their anisotropic nature and complicated architecture, it is very difficult to reveal the damage mechanism of these materials. Fiber composite materials are becoming an essential element in major technologies. Thus, an accurate evolution of their mechanical as well as chemical characteristics becomes very important, especially if they are used under various loading conditions and also at above- and sub-ambient temperatures. The benefits of lightweight polymer matrix composite components to aircraft engines are well known. Although thousands of polymer composite components are currently in service, barriers still exist to further implementation in more structurally critical and at different temperature applications. Most of these barriers are associated with the inability to accurately predict component lives, and therefore, component life-cycles costs. A fiber reinforced composite materials with a polymer matrix is highly susceptible to damage by environmental parameters, like, moisture, high and cryogenic temperatures, UV radiation, and thermal shocks etc. Most polymers are also loading rate sensitive. A change in loading rate may result in variation of failure modes. Many theories point out the complexity of the phenomena that manifest at the fiber/matrix interface or interphase. The predominant failure mechanisms in a composite laminate are a very complex combination of energy absorption mechanism such as delamination mainly caused by mode II shear, matrix cracking due to transverse shear, and translaminar fracture in terms of fiber fracture and kinking. The interfacial area is dependent on the processing conditions, which are generally chemical, mechanical, and thermomechanical in nature. These may introduce spatial non-uniformity of properties at the fiber/polymer interface. Little, if any, literature regarding the effects of strain rate on the damage behaviour of environmentally aged FRP composites at different temperatures has been published to date. An interfacial reaction may further impart various morphological modifications to the matrix microstructure in proximity to the fiber surface. A great need exists for a critical assessment of micro-characterization of polymer composites at different temperatures and loading conditions.

The Institute has facilities like, Instron Tensile Testing Machine, Cryogenic and other environmental chambers, UV chambers, DSC, SEM to carry out the work. Atomic Force Microscopy (AFM) and Fourier Transform Infrared Spectroscopy (FTIR) Imaging techniques will certainly be meaningful and effective additions to perform critical and micro-characterization of very small interactions and chemical structural gradient at the interphase of polymer composites. The main objective of investigations is to assess and correlate on the influence of structural gradient at the fibre/polymer interface on mechanical behaviour of advanced and hybrid composites, consisting synthetic fibres such as glass, carbon and Kevlar fibers.