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EDUCATION

- 1978 Ph.D Indian Institute of Technology, Kanpur, India
- 1970 M.Tech. Indian Institute of Technology, Kanpur, India
- 1968 B.E. Bengal Engineering College, Calcutta University, India

EXPERIENCE-RESEARCH

1999 Professor and Head, Department of Metallurgical and Materials Engineering, University of Roorkee

2000 Visiting Professor Technical University, Berlin under DST-DAAD exchange Programme to work on surface modification of polymer by DC and RF glow discharge

1992-1978-1989 Professor, Department of Metallurgical & Materials Engineering, University of Roorkee, India.

Worked on creep modelling for isotropic and anisotropic composite rotating components under multiaxial stress and also for FGM composites

Worked on tribological properties of aluminium and magnesium alloy based metal matrix composites including hybrid composites containing flyash, graphite and alumina and examined the limit of applicability of Archard's law to these materials.

Worked on the casting characteristics and mechanical properties of rheocast, compocast and stircast metal matrix composites (MMC) and established the reasons for high porosity in stirred composites and provided a framework for optimization of process variables; investigated high temperature properties of compocast Al-Al₂O₃ composites and the damaging role of porosities; developed a new concept for inhomogeneous heat treatment of rheocast alloys through partial homogenization and ageing.

Worked on surface modification of HDPE and PP polymers by glow discharge, resulting changes on surface energy and its consequence on the strength of its joint with metal.

Investigated the structure and properties of electroless microcrystalline and amorphous Ni-P and Ni-Co-P alloys and their crystallization behavior.

Critically evaluated the process parameters of intercritically annealed plain carbon dual phase steel and optimized mechanical properties by control of annealing time and temperature; proposed a method for theoretically predicting the optimum time and temperature of annealing from their kinetic behavior.

Proposed a density functional real space theory for bonding.

1995 Visiting Professor, Department of Materials, University of Wisconsin-Milwaukee, USA.

Worked on centrifugal casting of Cu-alloy-graphite composites and on castability of Al-flyash slurry. Participated in Cast-Metal Matrix Composites (MMC) Committee by invitation of American Foundrymen's Society (AFS).

1993 (June July) Invited Professor, Genie Physique et Mecanique des Materiaux, Institut National Polytechnique de Grenoble, France.

Initiated a collaborative study on "Particle Settling during Holding of Melt-Particle Slurry before Casting Composite Components."

1993 (Nov.-Dec) INSA Exchange Visitor, Centre des Materiaux Pierre Marie Fourt, Ecole de Mines, Paris and Laboratoire de Thermodynamique et Physico-chimie Metallurgique, Grenoble, France.

Delivered a Series of Invited Lectures on (i) Outstanding Problems in Component Casting and (ii) Interface Design of Composites.

1989-1992 Visiting Scientist and Adjunct Associate Professor, Department of Materials, University of Wisconsin-Milwaukee.

Development of free machining cast copper alloy-graphite composite, component casting from aluminium alloy-SiC and aluminum alloy-graphite composites for engineering and industrial applications. The composites have excellent machinability, damping and wear resistance properties. Significant studies were conducted to understand heterogeneous nucleation during solidification of cast composites.

1977-1978 Research Scientist, National Physical Laboratory, India.

Developed a diffusion model to explain the growth exponents in A-15 superconductors prepared by bronze route; the kinetic law for annealing revealed optimum diffusion time and couple chemistry.

1973-1977

Graduate student and Senior Research Assisstant in the Department of Metallurgical Engineering and Department of Physics, Indian Institute of Technology, Kanpur, India.

Developed for the first time the stirring technique for preparing Al-Al₂O₃ composite by foundry method; discovered the surface active agent, magnesium, now extensively used for cast composites and the stircasting method for synthesis of cast MMC.

Developed an approach for calculating the heat of solution for dilute metallic alloy by density functional formalism.

1972-1973

Research Scientist, National Aeronautical Laboratory, Bangalore, India.

Carried out investigation on correlation energy in electron gas.

EXPERIENCE-TEACHING & RESEARCH GUIDANCE

1992-

1978-1989

Developed a number of undergraduate and graduate courses in the Department of Metallurgical Engineering, University of Roorkee on (i) Application of numerical analysis and computer programming to metallurgical problems, (ii) Diffusion theory, and (iii) Alloy theory.

Taught undergraduate courses at University of Roorkee on (i) X-ray Metallography, (ii) Physics of Metals, (iii) Mechanical Behaviour of Metals, (iv) Metallurgy of Joining, (v) Mechanical Working of Metals, (vi) Materials Engineering, and (vii) Expt. techniques.

Selected graduate courses were offered on (i) Theory of Metal Forming, (ii) Dislocation Theory and Deformation Behaviour, (iii) Theory of Alloy Phases (iv) Diffusion in Solids, (v) Quantitative Metallography.

Supervised 25 Masters dissertations in Metallurgy & Materials Science

1. Fabrication of Al-almina Composites by Casting in Semi-solid condition, 1980.
2. Production and Characterisation of Al-glass Composites, 1980
3. Characterisation of Al-alumina Composites, 1980.
4. A study of Kinetics of Growth of Nb₃Sn in Cu-Sn-Cu-Nb Composites, 1980.
5. Geometry of Weld Bead Deposited on Mild Steel by Various Welding Processes, 1983.
6. Rheocasting of Al-Si Hypereutectic Alloy, 1985.
7. Problems in Indian High Strength Low Alloy (HSLA) Steel, 1985.

8. A Study on Composites with In-Situ Grown Dispersoids, 1987.
9. Kinetics of Recrystallization of Al-alumina Composite, 1987.
10. A Study on Oxide Superconductors and Their Properties, 1988.
11. Casting Fluidity in Al-alumina Slurry, 1993.
12. TIG Welding of Al-alumina Composites, 1993.
13. Heterogeneous Nucleation during Solidification of Al- alumina Composites, 1993.
14. Development of In-situ Fe-15 vol% TiC Composites, 1993.
15. Effect of Cold Working on Morphology of Martensite and Mechanical Properties of Dual Phase Steels, 1994.
16. Development of In-Situ Fe-25 vol% TiC Composites, 1994.
17. Wear Resistance of Dual Phase Steel, 1994.
18. Synthesis of aluminium-alumina composite with in-situ generated dispersoids, 1995.
19. Tribological behaviour of Al-C composite containing in-situ generated carbon particles, 1995.
20. Surface modification of PP by DC glow discharge, 1999.
21. Tribological behaviour of two-dimensional elastic surface using spectral analysis, 1999.
22. Mathematical Modeling of Casting Fluidity, 2001.
23. ANN Modelling of Shape Rolling, 2002.
24. Modelling of Roll force in Cold Rolling Mill, 2003.
25. Modelling and Design of pH and temperature controller for Electless plating bath, 2003.

Supervised 16 Doctoral dissertations on different novel casting techniques of alloys and composites, crystallization of amorphous materials and heat treatment, development of low friction wear resistant material as given below:

1. Microstructure and Mechanical Properties of Rheocast Alloy, 1983.
2. Ageing Characteristics of Rheocast Al-Cu Alloys, 1985.
3. Mixing Characteristics and Mechanical Properties of Cast Al(Mg)-alumina Particulate Composites, 1986.
4. Bonding of Pure Solids- a Density Functional Approach, 1986.
5. Annealing Studies on Structure and Properties of Amorphous Metal-Metalloid System Ni_(100-x)P_x, 1986.
6. Subsolidus Equilibria Relations in CoO-MgO-Fe₂O₃ System in air and Magnetic Behaviour of Spinel Phase, 1987.
7. Influence of Intercritical Annealing on Mechanical Properties of Plain Carbon Dual Phase Steel, 1989.
8. Crystallisation Kinetics and Annealing Studies on Amorphous Metal-Metalloid System - Ni-Co-P, 1990.
9. Structural Studies and Crystallisation Behaviour of Electroless Ni-P films, 1990.
10. Fabrication of Cast Al-base Lead Bearing Alloys and Their Wear Characteristics, 1990.
11. Synthesis and Tribological Characterisation of Aluminium base Composites, 1998.
12. Magnesium and AZ91 alloy based Cast composites and their

- Tribological Characteristics, 1999.
13. Flow Behaviour and Creep Deformation in Engineering Components of Composites, 2000.
 14. Studies on Tribological Characteristics of Dual Phase Steel, 2001.
 15. Characteristics of Adhesive Joining of HDPE and PP to Steel, 2001.
 16. Development and Study of Austempered Ductile Iron., 2001.

1989-1992 Taught the following undergraduate courses in the School of Engineering, University of Wisconsin, USA.

(a) Materials processing, and, (b) Selection of materials

Taught the following graduate and undergraduate combined course on (i) Ceramics and polymeric materials.

HONOURS AND AWARDS

University Gold Medal for ranking First in Bachelor of Engineering (Met.) at Calcutta University, 1968.

University Grants Commission National Associateship Award for Contribution to Research on Materials".

Annual Medal of Materials Research Society of India, 1994, for contribution in the field of Metal Matrix Composites.

PROFESSIONAL SOCIETIES AND ACTIVITIES

Member, Materials Research Society, India

Guest Editor, Materials issue of Indian Journal of Technology, India

Past Member, Editorial Board, Journal of Scientific and Industrial Research, India

Member, Advisory Board, Key Engineering Materials, Switzerland.

Member, Metals Council, Indian Institute of Metals

LIST OF PATENTS AND PUBLICATIONS

PATENT

"Preparation of Aluminium-Alumina Composites with Improved Properties by Casting Metals." (by P. K. Kelkar, P.K. Rohatgi and S. Ray), Indian Patent No: 124305 A, 1970.

LIST OF PUBLICATION

A. Composite & Multi-phase Materials

1. Rajnish Tyagi, S. K. Nath and S. Ray, "Modelling of Dry Sliding Oxidation Modified Wear in Two Phase Materials", *Wear*, 255 (2003), p.327-332.
2. V. K. Gupta, S. B. Singh, H. N> Chandrawat and S. Ray, 'Creep in Isotropic Rotating Disc of Al-SiC_p Composites", *Indian J. pure appl. Math*, 34 (2003), p.1797-1807.
3. S. B. Sharma, R. C. Agarwala, V. Agarwala and S. Ray, "Application of Ni-P-ZrO₂-Al₂O₃-Al₃Zr Electroless Composite Coatings and Their Characteristics", *Surface Engg.*, 18 (2002), p.344-349.
4. Rajnish Tyagi, S. K. Nath and S. Ray, "Effect of Martensite Content on Friction and Oxidative Behavior of 0.42 pct. Carbon Dual Phase Steel", *Met.and Mater.Trans.*, 33A (2002), p.3479-3488.
5. Punit Kumar, S. C. Jain and S.Ray, "Thermal EHL of Rough Rolling/Sliding Line Contacts using a Mixture of Two Fluids at Dynamic Loads", *Trans. ASME, Journal of Tribology*, 124(2002),p.709-715.
6. S. B. Sharma, R. C. Agarwala, V. Agarwala and S. Ray, "Dry Sliding Wear and Friction Behavior of Ni-P-ZrO₂-Al₂O₃ Composite Electroless Coatings on Aluminium", *Materials & Manufacturing Proc.*, 17(2002), p.639-649.
7. S. B. Singh and S. Ray, "Modelling of Anisotropy and Creep in Aluminium-Silicon carbide Composite Rotating Disc", *Mechanics of Materials*, 34 (2002), p.363-372.
8. S.Ray, "Metal Matrix Composites – New Horizon for Metallic Materials", invited key note paper in Proc. Int. Conf. On Advances in Materials and Materials Processing, ICAMMP, held at IIT, Kharagpur during February 1-3, 2002, India, p.63-70.
9. S. B. Sharma, R. C. Agarwala, V. Agarwala and S. Ray, "Dry Sliding Wear and Friction Behaviour of Ni-P-ZrO₂-Al₂O₃", *Proc. Int. Conf. On Advances in Materials and Materials Processing, ICAMMP*, held at IIT, Kharagpur during February 1-3, 2002, India, p.326-330.
10. Rajnesh Tyagi, S. K. Nath and S. Ray, "Modelling of Dry Sliding Oxidative Wear in Dual Phase Steel", *Proc. Int. Conf. On Advances in Materials and Materials Processing, ICAMMP*, held at IIT, Kharagpur during February 1-3, 2002, India, p.669-673.
11. S. B. Singh and S. Ray, "Steady state creep behaviour in an isotropic FGM rotating disc of Al-SiC Composite", *Met.and Mater.Trans.*, 32A (2001), p.1679-1685.
12. S. B. Singh and S. Ray, "Residual Stress and Steady State Creep in Anisotropic Composite Rotating Disc", *Proc. Int. Conf. On Advanced Materials Processing Technologies* held at Universidad Carlos III de Madrid, Spain, 2001, p.1569-1575.
13. Rajnesh Tyagi, S. K. Nath and S. Ray, "Dry sliding friction and wear in plain carbon dual phase steel", *Met.and Mater.Trans.*, 32A (2001) p.359-367.

14. V.K.Rai, R.Srivastava, S.K.Nath and S.Ray, "Wear in cast TiC reinforced ferrous composites under dry sliding", *Wear*, 231(1999) p.265-271.
15. J.A.Al-jarrah, P.K.Ghosh and S.Ray, "Solidification processing and properties of cast $Al - Al_2O_3$ composite", Proceedings of the sixth Asian foundry congress, Indian Institute of Foundrymen, India, 1999, p.271-283.
16. S.Bhowmik, P.K.Ghosh, S.Ray and S.K.Barthwal, "Surface modification of high density polyethylene and polypropylene by DC glow discharge and adhesive bonding to steel", *J.Adhesion Sci.Technol.*, 12 (1998) p.1181-1204.
17. J.A.Al-jarrah, P.K.Ghosh and S.Ray, "Mixing and solidification processing of $Al - Al_2O_3$ composite", Proceedings composite materials "COMPEAT-1998", National Metallurgical Laboratory, India, 1998, p.9-25.
18. S.B.Singh, S.Ray. R.K.Gupta and N.S.Bhatnagar, "Influence of anisotropy on creep in a whisker reinforced MMC rotating disc", Proceedings composite materials "COMPEAT-1998", National Metallurgical Laboratory, India, 1998, p.83-102.
19. J.A.Al-Jarrah, S.Ray and P.K.Ghosh, "Solidification processing of $Al - Al_2O_3$ composite using turbine stirrer", *Met.and Mater.Trans.*, 29A (1998) p.1711-1719.
20. P.K.Rohatgi, R.Q.Guo, P.Huang and S.Ray,"Friction and abrasion resistance of cast aluminium alloy-flyash composites", *Met.and Meter.Trans.*, 28A (1996) p.245-250.
21. S.Ray, "Casting of Metal Matrix Composites", *Metal Matrix Composites, Part 1 : Applications and Processing* (Ed. by:G.M. Newaz H. Neber-Aeschbacher and F.H. Wohlbiel), Trans Tech Publications, 1995, p.417-446.
22. S.Ray, "Cast Metal Matrix Composites - Challenges in Processing and Design", *Bull. Mat. Sc.*, 18 (1995) p. 693-709.
23. P.K.Rohatgi, R.Q. Guo and S.Ray, "Casting Characteristics of Al-Flyash Composite" Proceedings AFS 100th Casting Congress, Philadelphia, April 20-23, 1996.
24. P.K.Rohatgi, J.Sobzak, J.Kim and S.Ray, "Centrifugal Casting of Lead Free Copper Graphite Alloys", Proceedings AFS 100th Casting Congress, Philadelphia, April 20-23, 1996.
25. S.Ray, "Casting of Composite Components" in *Inorganic Matrix Composites*, Proceedings of the Minerals, Metals and Materials Society, Pennsylvania, USA, 1996, pp.69-90.
26. P.K.Rohatgi, S.Ray and Y. Liu, "Tribological Properties of Metal Matrix-Solid Lubricant Composites," *ASLE Handbook of Lubrication and Tribology, Vol.III* (ed. by E. R. Booser), CRC Press Inc., 1994, pp. 149-166.
27. S.Ray, "Casting of Metal Matrix Composite Components from Slurry", *Indian Foundry Journal Special issue* (1994) pp. 37-44.

28. C.G. Kang, S. Ray and P. K. Rohatgi, "A Micro-Mechanical Solidification Heat Transfer in One Dimensional Al-Al₂O₃ Composite and its Consequence on Microstructure Evolution", *Materials Science & Engg.*, A188(1994) pp. 193-194 1994.
29. P.K.Rohatgi, K.Pasciak, C.S.Narendra nath, S.Ray and A.Sachdeva, *Journal of Mat. Sc.*,29 (1994) pp.5357.
30. S.Mohan, V.Agarwala and S.Ray, "Wear Characteristics of Al-Pb, Al-Sn, Al-Pb-Sn and Al-(Pb-Sn) Alloys: A Comparative Study" *Communicated to Materials Trans. JIM*.
31. S.K. Nath, S. Ray, V. N. S. Mathur and M.L. Kapoor, "A Single Particle Model for Theoretical Estimation of Tensile Strength of Dual Phase Steel", *Advanced Composites'93* (Ed. by:T.Chandra & A. K. Dhingra) *The Minerals, Metals and Materials Soc., USA*, pp. 1295-1299, 1993.
32. S.Mohan, V. Agarwala and S.Ray, "Production of Al-Pb Composites", *Banaras Metallurgist*, 12-13(1993)pp. 67-70.
33. P.K.Ghosh and S.Ray, "Influence of Annealing on the Mechanical Properties of Compcast Al(Mg)-Al₂O₃ Particulate Composite," *J. Mat. Sc.*, 28 (1993) pp. 3783-3788.
34. Y.Liu, P.K. Rohatgi and S.Ray, "Tribological Characteristics of Aluminum-50 vol% Graphite Composite," *Met. Trans.*, 24(1993) pp. 151-160.
35. S.Ray, "Synthesis of Cast Metal Matrix Composites," *J. Mat. Sc.*, 28 (1993) pp. 5397-5415.
36. S.Ray, "Process Developments for Fabrication of Cast Metal Matrix Particulate Composites- Unsolved Problems, " *Trans. IIM*, 45 (1992) pp.69-77.
37. P.K.Rohatgi, D. Nath and S. Ray, " Casting Characteristics of Machinable Lead Free Copper-Graphite Alloys". *AFS Transactions*, 104 (1993) pp. 49-58.
38. F.M. Yarandi, P.K. Rohatgi and S.Ray, "Settling, Casting Fluidity and Solidification Behavior of Aluminium-SiC Particle Composite", *Key Engg. Materials*, 79-80(1993) pp. 91-104.
39. S.Mohan, V. Agarwala and S. Ray, "Fabrication of Cast Leaded Aluminium Alloys," *Berg-und Hutten. Mon.*, 127 (1992) pp. 430-434.
40. P.K.Rohatgi, S.Ray, R. Asthama and C.S. Narendranath, "Interfaces in Cast Metal Matrix Composites," *Materials Sc. & Engg.*, A162 (1993) pp. 163-174.
41. F.M.Yarandi, P.K. Rohtgi and S.Ray, "Two-phase Flow Behavior and Microstructure in Aluminum Alloy-SiC Particulate Reinforced Composites," *Proc. of Conf. on Semi-Solid Processing of Alloys and Composites*, presented at the MIT, Cambridge, USA, June 10-12, 1992, PP. 447-465.
42. S.Mohan, V. Agarwala and S.Ray, "Friction Characteristics of Stir-Cast Aluminium-Lead Alloys," *Wear*, 157 (1992) pp. 9-17.

43. F.M.Yarandi, P.K. Rohatgi and S.Ray, "Casting Fluidity of Aluminium A356-SiC Cast Particulate Composites," AFS Transactions, 100 (1992).
44. P.K.Rohatgi, S. Ray, D. Nath and N. Church, "Lead-free Mechinable Copper Alloy Castings Containing Graphite", AFS Transactions, 100 (1992) pp. 1-9.
45. P.K.Rohatgi, Y. Liu and S.Ray, "Friction and Wear Characteristics of Metal-Matrix Particulate Composite Materials." Invited paper for ASM Metals Handbook, Vol. 18,1992.
46. P.K.Rohatgi, S.Ray and Y. Liu, "Tribological Properties of Metal Matrix Graphite Particle Composites, " International Materials Review, 37 (1992) pp. 129-149.
47. Y.Liu, S.C. Lim, S.Ray and P.K. Rohatgi, "Friction and Wear of Al-Graphite Composite: Smearing Process of Graphite during Sliding," Wear, 159 (1992) pp. 201-205.
48. S.Mohan, V. Agarwala and S.Ray, "Morphology and Wear Characteristics of Rheocast Aluminium - Lead Bearing Alloys," Materials Trans. JIM, 33 (1992) pp. 861-869.
49. S.Mohan, V. Agarwala and S. Ray, "Microstructure and Particle Size Distribution in Stir-Cast Aluminium-Lead Alloys," Materials Trans. JIM, 33 (1992) pp. 1057-1062.
50. S.Mohan, V. Agarwala and S. Ray, "Liquid-Liquid Dispersion for Fabrication of Al-Pb Metal-Metal Composites," Materials Science and Engineering, A144 (1991) pp. 215-219.
51. S.Mohan, V. Agarwala and S.Ray, "Novel Casting Technique in the Production of Leaded Aluminium Alloys," Proc. Int. Conf. on Recrystallisation of Metallic Materials, RECRYSTALLISATION'90 (Ed. by T. Chand), TMS Publications, Pennsylvania, 1990, pp. 629-634.
52. P.K.Rohatgi, R. Asthana, R.N. Yadav and S.Ray, "Energetics of Particle Transfer from Gas to Liquid during Solidification Processing of Composites," Metal. Trans., 21A (1990) pp. 2073-2082.
53. P.K.Ghosh and S.Ray, "Solidification Structure in Compocast Al(Mg)-Al₂O₃ Particulate Composites," Proc. on Solidification of Metal Matrix Composites (Ed. by P.K. Rohatgi), TMS Publications, Pennsylvania, 1990, pp. 205-212.
54. S.Mohan, V. Agarwala and S.Ray, "Wear Characteristics of Rheocast and Stircast Al-Pb Metal-Metal Composites," Proc. of ASM Conf. on Tribology Composite Materials, (Ed. by P.K. Rohatgi, P.J. Blau and C.S. Yust), ASM Publications, Metals Park, Ohio, 1990, pp. 189-194.
55. P.K.Rohatgi, S. Ray and Y. Liu, "Friction and Wear of Metal Matrix-Graphite Particle Composites," Proc. of ASM Conf. on Tribology of Composite Materials, (Ed. by P.K. Rohatgi, P.J. Blau and C.S. Yust), ASM Publications, Metals Park, Ohio, 1990, pp. 1-14.
56. P.K.Ghosh and S. Ray, "Influence of Holding Temperature and Stirring Speed on the Surface Reaction Layer on Al₂O₃ Particles Embedded in Compocast Al-Mg Alloy," Z. Metallkunde, Vol. 81, (1990) pp. 25-29.

57. P.K.Ghosh and S.Ray, "Influence of Process Parameters on the Reacted Layer at Particle-Matrix Interface in Compocast Al(mg)-Al₂O₃ Composite," Proc. ASM Conf. on Fabrication of Particulates Reinforced Metal Composites (Ed. by J. Masounave and F.G. Hamel) (1990) pp. 23-29.
58. S.Mohan, V. Agarwala and S.Ray, "The Effect of Lead Content on the Wear Characteristics of a Stircast Al-Pb Alloy," Wear, Vol. 140 (1990), pp. 83-92.
59. S.Ray, "Cast Metal Matrix Composites-An Overview," Ind. J. Tech., Vol. 28 (1990), pp. 368-377.
60. S.Mohan, V. Agarwala and S.Ray, "Wear Characteristics of Stircast Al-Pb alloys," Z. Metallkunde, Vol. 80 (1989), pp. 904-908.
61. P.K.Ghosh and S. Ray, "Influence of Process Parameters on the Porosity Content in Al(Mg)-Al₂O₃ Cast Particulate Composite Produced by Vortex Method," AFS Transactions, Vol. 88 (1988) pp. 775-782.
62. S.Mohan, V. Agarwala and S.Ray, "Dispersion of Liquid Lead in Molten Aluminum by Stirring," Z. Metallkunde, Vol. 80 (1989), pp. 612-615.
63. P.K.Ghosh and S.Ray, "Effect of Mixing Parameters on the Microstructure of Compocast Al(mg)-Al₂O₃ Particulate Composite," Z. Metallkunde, Vol. 80 (1989), pp. 53-59.
64. S.Mohan, V. Agarwala and S.Ray, "Friction and Wear Characteristics of Stircast Al-Pb Alloys," Proc. Seminar on Materials and Metallurgy held in K. Regional Engineering College, Surathkal on April 24-25, 1989.
65. S.Mohan, V. Agarwala and S.Ray, "The Effect of Stirring Speed on the Wear Characteristics of Stircast Lead Al-Alloys," Proc. Silver Jubilee Conference on Alloy Design and Development held in Roorkee, India, on March 10-11, 1989.
66. P.K.Ghosh and S.Ray, "Particle Dispersion and Fluid-Particle Interaction in a Slurry of Liquid Al-Mg Alloy and Al₂O₃ Particles," Transactions, Japan Institute of Metals, Vol. 29 (1988), pp. 509-519.
67. P.K.Ghosh and S.Ray, "A Model Study on the Particle Dispersion and Fluid-Particle Interaction in Slurry of Liquid Alloy and Ceramic Particle," Transactions, Japan Institute of Metals, Vol. 29(1988), pp. 502-508.
68. P.K.Ghosh and S.Ray, "Fabrication and Properties of Compocast Al₂O₃ Composite," Indian Journal of Technology, Vol. 26 (1988), pp. 83-94.
69. S.Ray, "Porosity in Foundry Composites Prepared by Vortex Method," ASM Proceedings on Cast Reinforced Metal Composites (Ed. by S.G. Fishman and A.K. Dhingra), ASM Publication, Metals Park, Ohio, 1988, pp. 77-80.

70. P.K.Ghosh and S.Ray, "Effect of Porosity and Alumina Content on the High Temperature Mechanical Properties of Compocast Al₂O₃ Particulate Composite," *Journal of Materials Science*, Vol. 22 (1987), pp. 4077-4081.
71. P.K.Ghosh and S.Ray, "Effect of Porosity and Alumina Content on the Mechanical Properties of Compocast Aluminum Alloy-Alumina Particulate Composite," *Journal of Materials Science*, Vol 21 (1986), pp. 1667-1674.
72. P.R.Prasad, S. Ray, J.L. Gaindhar and M.L. Kapoor, "Mechanical Properties of Al-10 wt% Cu Alloy Particulate Composites," *Scripta Metallurgica*, Vol. 19 (1985), pp. 1019-1022.
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74. S.Ray, "Fracture of Particulate Composites," *Bulletin of Materials Science*, Vol. 6 (1984), pp. 799-804.
75. P.K.Ghosh, S.Ray and P.K. Rohatgi, "Incorporation of Alumina Particles in Aluminum-Magnesium Alloy by Stirring in Melt," *Transactions, Japan Institute of Metals*, Vol. 25 (1984), pp. 440-444.
76. R.K.Jain, S.Ray and D.B. Goel, "Characterization of Aluminum Glass Composites," *Seminar on Solidification and Casting of Metals*, Roorkee, India (1984), p. 22.
77. P.K.Ghosh and S.Ray, "Porosity and Fracture Behavior of Compocast Al-Al₂O₃ Composite," *Seminar on Solidification and Casting of Metals*, Roorkee, India, (1984), p. 20.
78. Kamlesh Chandra, S.Ray and D.B. Goel, "Development of Al-based Composites by Internal Oxidation," *Seminar on Solidification and Casting of Metals*, Roorkee, India (1984), p. 21.
79. P.K.Ghosh, S.Ray and R.C. Agarwala, "Reaction Annealing of Copper-Tin Copper-Niobium Composite." *Journal of Materials Science Letter*, Vol. 3 (1984), pp. 370-374.
80. B.V.Reddi, V. Raghavan, S.Ray and A.V. Narlikar, "Growth Kinetics of Monofilamentary Nb₃Sn and V₃Si Synthesized by Solid State Diffusion," *Journal of Materials Science*, Vol 18 (1983), pp. 1165-1173.
81. V.Balasubramanian and S.Ray, "Kinetics of Growth of Nb₃Sn by Bronze Route Process-A Model Calculation," *Trans. Indian Institute of Metals*, Vol. 36 (1983), pp. 291-294.
82. R.Narayan, S.Ray and P.K. Rohatgi, "Energetics of Particle Transfer to Liquid Metal," *DAE Symposium on Surface and Interface Properties in Materials Science held on October 13-15 (1980)*, p. 30.
83. S.O.Singh, S. Ray, and D.B. Goel, "Role of Magnesium in Promoting Bonding between Alumina and Aluminum," *Proceedings of Symposium on Surface and Interface Properties in Materials Science, held on October 13-15 (1980)*, p. 188.

84. B.V.Reddi, S.Ray, K.C. Nagpal, A.V. Narlikar and V. Raghavan, "Growth Kinetics of Nb₃Sn Layer in Nb-Bronze Matrix," Proceedings of Instrumental Techniques in Materials Research DAE Symposium held in Rourkela, (1977). p. 281.
85. B.C.Pai, S.Ray and P.K. Rohatgi, "Fabrication of Aluminum-Alumina Particulate Composites in Foundries Using Magnesium Additions to the Melts," Materials Science and Engineering, Vol. 24 (1976), pp. 31-47.

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