

Sudarsanam Suresh Babu

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Senior R&D Staff
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Professional Experience

1997 –Senior Research and Development Staff (2002-)
Research and Development Staff (1997-2001)
Research Professor (1996-1997)
Post Doctoral Scholar (1993-1996)
Oak Ridge National Laboratory, Oak Ridge, TN 37831-6096

Responsibilities include basic and applied research in welding metallurgy, phase transformations in steel, aluminum alloys, and nickel-base superalloys. For the first time successfully tracked the nonequilibrium phase formation during rapid weld cooling conditions using in-situ synchrotron diffraction. Modeled the inclusion formation in welds that has remained as an intractable problem before. Developed and executed wide range of applied projects related to welding consumable development, thermodynamics of alloy corrosion, high-temperature corrosion and advance welding process.

1992- 1993 Research Associate
Institute for Materials Research, Tohoku University, Sendai, Japan
Research into nanostructured magnetic materials, aluminum alloys and understanding fundamental phase transformations in steels using atom probe field ion microscopy. The research led to first experimental proof for the growth of paraequilibrium cementite during martensite tempering.

Education

1988 - 1992 Ph.D. (Materials Science)
University of Cambridge, Cambridge, UK

With physical metallurgy principles, innovative experiments, and computational models a complex microstructural transition that was observed in Fe-Cr-C welds was explained. The research paper based on these results was awarded with a prestigious Pfeil medal.

1986 - 1988 Master of technology (Industrial Metallurgy - Welding)
Indian Institute of Technology, Madras, INDIA

By rapidly cooling the weld metal with Cu-backing, the weld microstructure and properties of Al-Zn-Mb alloys were improved. Graduated with distinction and Sudarshan Bhat Memorial Award

1982 - 1986 Bachelor of Engineering (Metallurgy)
P. S. G. College of Technology, Coimbatore, INDIA

Designed and fabricated a cold-chamber low-pressure die casting unit for Zinc-base alloys as an undergraduate thesis project. The thesis was recognized with best project award from Director of Technical Education, Madras, INDIA. Graduated with distinction.

Teaching Experience

2001 Intensive 2-week teaching on "Trends in Welding Science" and "Steel Processing and Weld Microstructure Evolution"
Departamento de Ciencia dos Materiais e Metalurgia at Pontificia Universidade Catolica Do Rio de Janeiro (PUC-Rio), Brazil

1988-1991 Undergraduate lab teaching
University of Cambridge, UK

Patents and Publications

Number of Patents: 1; Number of publications: 83 (49 refereed journals, 32 conference proceedings, others 2); Number of presentations: 45 (17 invited talks, 28 conference presentations)

Professional Activities

Member of seed money review committee at Oak Ridge National Laboratory, Member of American Welding Society technical papers Committee; Organizing member of HTM 21 Symposium at NIMS, Tsukuba, Japan; Board of review in Science and Technology of Welding and Joining from 2001, Metallurgical and Materials Transactions, A from 1996; Serving as reviewer in reputed international journals including *Phil. Mag. A*, *Acta Materialia*, *Welding Journal*, *Scripta Metall. Mater*, and *Science Technology of Welding and Joining*, *Journal of Materials Research*, and *Materials Research Bulletin*

Professional Membership

Cambridge Commonwealth Trust, UK; American Welding Society; ASM International; Sigma Xi and TMS

Research Interests

Weld microstructure modeling based on thermodynamics and kinetics; Computer aided models to solve the industrial related problems; Phase transformations in steels, aluminum alloys & Ni-base super alloy; Fundamental issues in

non-equilibrium phase transformations; Application of in-situ neutron and synchrotron diffraction tools, atom probe field ion microscopy and electron microscopy; Laser surfacing for improvement of structural and biomaterial surfaces; Novel phase transformation concepts to join nanostructured materials

Awards Received

Co-recipient of Mc-Kay Helm Award from American Welding Society (2002)
Co-recipient of AWS-W. F. Savage Award for the paper which was judged the greatest contribution to the welding metallurgy published in the welding journal (2002)
UT-Battelle Significant Research & Development Accomplishment Award (2000)
Professor Masubuchi / MIT Award from American Welding Society for advancing science and technology of materials joining through research and development (1998)
Co-recipient of Warren F. Savage Memorial Award for the paper which was judged the greatest contribution to the welding metallurgy published in the welding journal (1998)
ASM-IIM India Visiting Lecture Award (1997)
Pfeil Medal for the research paper of in physical metallurgy by the Institute of Metals, London, UK (1991)
Cambridge Commonwealth Trust-India Scholarship for doctoral study and Overseas Research Student award (ORS) for the doctoral study in the United Kingdom by the Council of Vice Chancellors and Principals of the Universities in the UK (1988)
Certificate of academic distinction (Sudarshan Bhat Memorial award) for the best academic record during the Master of Technology degree at IIT Madras, INDIA (1988)
Special scholarship by KCP Industries for the best academic achievement (1987)
Best project award during Bachelor of Engineering degree, sanctioned by the Director of Technical Education, Madras, INDIA (1986)
Academic proficiency award during the Bachelor of Engineering degree (1986)

Current Research Projects

US-DOE-OIT Supporting industries research on novel optimization of welding process / consumable selection in collaboration with Lincoln Electric Company, OH (2002 -).
US-DOE OIT research on new high-temperature corrosion resistant alloys for ethylene cracking tubes (2000-2002)
US-DOE OIT research on prediction of corrosion of alloys in mixed solvent environment (2000-2002)
ORNL seed money proposal for development of in-situ neutron characterization tools to understand phase transformations in nickel base superalloys (2000-)
ORNL seed money proposal for development of problems solving environment for integrated weld process modeling (2001-)
Collaborative DOE project with OLI Systems to predict the corrosion of alloys in mixed solvent environments (2000-)

Fundamentals of Welding Science: *In-situ* Synchrotron time-resolved X-ray diffraction, Thermodynamic and Kinetic Modeling and Atom Probe Tomography (1996-)

MPLUS research programs on friction stir welding, inclusion formation, laser surface alloying and transformation kinetics (1997-)

Publications of Sudarsanam Suresh Babu

Journal Papers

2003

1. Babu, S. S., David, S. A., Park, J. W. and Vitek, J. M., "Joining of nickel base superalloy single crystals," paper presented at International Conference on Microstructure and Performance of Joints in High-Temperature Alloys, London 2002, being considered for publication in *Science and Technology of Welding and Joining*, 2002
2. Trivedi, R., David, S. A., Eshelman, M. A., Vitek, J. M., Babu, S. S., Hong, T., and DebRoy, T., "In-situ observations of weld pool solidification using transparent metal analog systems," submitted for publication in *Journal of Applied Physics*, 2002.
3. Babu, S. S., Vitek, J. M, Miller, M. K., and David, S. A., "Nonequilibrium microstructure evolution in nickel base superalloys," accepted for publication in *Materials Science and Engineering A*, 2002.

2002

4. Miller, M. K., Babu, S. S., and Burke, M. G., Comparison of phase composition in alloy 718 measured by atom probe tomography and predicted by thermodynamic calculations, *Materials Science and Engineering A*, 2002, **A327**, 84-88.
5. Miller, M. K., Babu, S. S., Sokolov, M. A., Nanstad, R. K., and Iskander, S. K., Effect of stress relief temperature and cooling rate on pressure vessel steel welds, *Materials Science and Engineering*, 2002, **A327**, 76-79.
6. Babu, S. S., Elmer, J. W., David, S. A., and Quintana, M., "In-situ observations of nonequilibrium austenite formation during weld solidification of Fe-C-Al-Mn low alloy steel," *Journal of Proceedings of Royal Society (Mathematical and Physical Sciences) A*, 2002, **458**, 811-821
7. Babu, S. S., Martukanitz, R. P., Parks, K. D., and David, S. A., "Toward prediction of microstructure evolution during laser surface alloying," *Metallurgical and Materials Transactions A*, 2002, **33A**, 1189-1200.
8. Babu, S. S., Elmer, J. W., Vitek, J. M., and David, S. A., "Time-resolved X-ray diffraction of primary weld solidification in Fe-C-Al-Mn steel welds," *Acta Materialia*, 2002, **50**, 4763-4781.
9. Babu, S. S., David, S. A., "Inclusion formation and microstructure evolution in low alloy steel welds," invited paper for the Special Issue for International Conference on Advanced Structural Steels (ICASS 2002) in *ISIJ International*, 2002.

2001

10. Babu, S. S., David, S. A., Vitek, J. M., and Reed, R. W., Solidification and microstructure modeling of welds in aluminum alloys 5754 and 6111, *Science and Technology of Welding and Joining*, 2001, **6**, 31-40.
11. Quintana, M. A., McLane, J., Babu, S.S., David, S. A. †, Inclusion formation in self shielded flux-cored arc welds, *Welding journal*, 2001, **80**, 98s-105s.
12. Oertelt, G., Babu, S. S., David, S. A., and Kenik, E. A. †, Effect of thermal cycling on friction stir welds of 2195 aluminum alloy, *Welding Journal*, 2001, **80**, 71s-79s.
13. Babu, S. S., David, S. A., and Quintana, M., Modeling microstructure evolution in self-shielded flux cored arc welds, *Welding journal*, 2001, **80**, 91s-97s.
14. Wang, D.-Q., Babu, S. S., Payzant, E. A., and Radaelli P. G., and Hannon, A. C., "In-situ Characterization of γ/γ' lattice stability in a nickel base superalloy by neutron diffraction," *Metallurgical and Materials Transactions A*, 2001, **32A**, 1551-1552.
15. Babu, S.S., Santella, M.L., Feng, Z., Riemer, B. W., and Cohron, J. W., An empirical model of the effects of pressure and temperature on the electrical contact resistance of metals, *Science and Technology of Welding and Joining*, 2001, **6**, 126-132.
16. David, S. A., Babu, S. S., and Vitek, J. M., Recent advances in modeling and characterization of weld microstructures, *Science and Technology of Welding and Joining*, 2001, **6**, 341-346.
17. Babu, S. S., Miller, M. K., Vitek, J. M., David, S. A., "Characterization of the microstructure evolution in a nickel base superalloy during continuous cooling," *Acta Materialia*, 2001, **49**, 4149-4160.

2000

18. Hong, T., DebRoy, T., Babu, S. S., and David, S. A.: Modeling of Inclusion Growth and Dissolution in the Weld Pool, *Metallurgical Transactions B.*, 2000, Vol **31B**, 161-169.
19. Hofer, P., Miller, M. K., Babu, S. S., David, S. A., and Cerjak, H. Atom Probe Field Ion Microscopy Investigation of Boron Containing Martensitic 9% Chromium Steel, *Metallurgical and Materials Transactions A*, 2000, **31A**, 975-984.
20. Babu, S. S., David, S. A., Miler, M. K., Application of atom probe microanalysis for understanding microstructure evolution in nickel base superalloy welds, *Microscopy and Microanalysis*, 2000, **6**, 350-351.

1999

21. Babu, S. S., Reidenbach, F., David, S. A., Böllinghaus, Th., and Hoffmeister, H.: Effect of high-energy-density welding processes on inclusion and microstructure

† This paper was awarded with McKay-Heml award from American Welding Society.

† This paper was awarded with Warren F. Savage memorial award from American Welding Society.

- formation in steel welds, *Science and Technology of Welding and Joining*, 1999, **4**, 63-73.
22. Miller, M.K., Babu, S. S., Burke, M. G.: Intragranular precipitation in Alloy 718, *Materials Science and Engineering A*, 1999, Vol. A270, 14-18.
23. Babu, S. S., David, S. A., Vitek, J. M., Mundra, K., and DebRoy, T.: A model for inclusion formation in low alloy steel welds, *Science and Technology of Welding and Joining*, 1999, Vol. **4**, 276-284.

1998

24. Babu, S. S., Goodwin, G. M., Rohde, R. J., and Sielen, B.: Effect of boron on the microstructure of low-carbon steel resistance-seam welds, *Welding Journal*, 1998, **77**, 249s-253s.
25. Babu, S. S., David, S. A., Vitek, J. M., and Miller, M. K.: High resolution analysis of elemental partitioning in nickel-base superalloy welds using atom probe field ion microscopy, *Microscopy and Microanalysis*, 1998, Vol. **4**, 94-95.

1997

26. David, S. A., Vitek, J. M., Babu, S. S., Boatner, L., and Reed, R. W.: Welding of Nickel-base Superalloys Single-crystals, *Science and Technology of Welding and Joining*, 1997, **2**, 79-88.
27. Mundra, K., DebRoy, T., Babu, S. S., and David, S. A.[†] Weld metal microstructure calculations from fundamentals of transport phenomena in the arc welding of low alloy steels, *Welding Journal*, 1997, **76**, 163s-171s.
28. David, S. A. and Babu, S. S.: Modeling microstructure development in weld metals, *Transactions of the Indian Institute of Metals*, 1997, **50**, 591-602.
29. Babu, S. S., Vitek, J. M., Iskander, Y. S., and David, S. A.: A new model for prediction of ferrite number of stainless steel welds, *Science and Technology of Welding and Joining*, 1997, **2**, 279-285.

1996

30. Babu, S. S., David, S. A., Vitek, J. M., and Miller, M. K.: Phase stability and atom probe field ion microscopy of Type 308 CRE stainless steel weld metal, *Metall. & Mater. Trans. A.*, **27A**, 1996, 763-774.
31. Babu, S. S., David, S. A., and Miller, M. K.: Microstructural development in PWA1480 electron beam welds - An atom probe field ion microscopy study, *Applied Surface Science*, **94/95**, 1996, 280-287.
32. Hsieh, K. C., Babu, S. S., Vitek, J. M., and David, S. A.: Calculation of inclusion formation in low alloy steel welds, *Materials Science and Engineering*, 1996, **A215**, 84-91.
33. Babu, S. S., David, S. A. and DebRoy, T.: Coarsening of oxide inclusions in low alloy steel welds, *Science and Technology of Welding and Joining*, 1996, **1**, 17-27.

[†] This paper was awarded with Warren F. Savage memorial award from American Welding Society.

34. Babu, S. S., David, S. A., Vitek, J. M., and Miller, M. K.: Atom Probe Field Ion Microscopy Investigation of CMSX-4 Ni-base Superalloy Laser Beam Welds, *J. de Physique IV*, 1996, **6**, C5-253-C5-258.

1995

35. Babu, S. S., David, S. A., Vitek, J. M., Mundra, K., and DebRoy, T.: Development of macro – and microstructures of C–Mn low alloy steel welds – Inclusion Formation, *Materials Science and Technology*, **11**, 1995, pp. 186-199.
36. Babu, S. S., David, S. A., Vitek, J. M., and Miller, M. K.: Atom probe field ion microscopy of type 308 CRE stainless steel welds, *Applied Surface Science*, **87/88**, 1995, pp. 207-215.
37. Babu, S. S., and Bhadeshia, H. K. D. H.: Diffusion of carbon in substitutionally alloyed austenite, *Journal of Materials Science Letters*, **14**, 1995, 314-316.
38. Joslin, D. L., Easton, D. S., Liu, C. T., Babu, S. S., and David, S. A.: Processing of Fe₃Al and FeAl alloys by reaction synthesis, *Intermetallics*, **3**, 1995, 467–481.

1994

39. Babu, S. S., Hono, K. and Sakurai, T.: APFIM study of the partitioning of substitutional elements during tempering of a low alloy steel martensite, *Metall. Trans. A.*, **25A**, 1994, pp. 499–508.
40. Hono, K., Maeda, Y., Babu, S. S. and Sakurai, T.: Compositional inhomogeneities in sputtered Co–Cr magnetic thin films studied by atom probe field ion microscopy, *Journal of Applied Physics*, **76**, Dec. 15. 1994, pp. 8025-8031.

1993

41. Hono, K., Sano, N., Babu, S. S., Okano, R. and Sakurai, T.: Atom probe study of the precipitation process in Al–Cu–Mg–Ag alloy, *Acta. Metall. Mater.*, **41**, 1993, pp. 829–838.
42. Babu, S. S., Hono, K. and Sakurai, T.: APFIM studies on martensite tempering of Fe–C–Si–Mn low alloy steel, *Applied Surface Science*, **67**, 1993, pp. 321–327.
43. Babu, S. S., Hono, K., Okano, R. and Sakurai, T.: APFIM studies on some aluminum alloys, *Applied Surface Science*, **67**, 1993, pp. 361–367.
44. Hono, K., Hasegawa, N., Babu, S. S., Fujimori, H. and Sakurai, T.: Atom probe analysis of nanocrystalline Fe–C–Ta sputtered soft magnetic thin film, *Applied Surface Science*, **67**, 1993, pp. 391–397.
45. Hono, K., Babu, S. S., Maeda, Y., Hasegawa, N. and Sakurai, T.: Atom probe compositional analysis of Co–Cr sputtered magnetic thin films, *Appl. Phys. Lett.*, **62**, 1993, pp. 2504–2506.

1992

46. Babu, S. S. and Bhadeshia, H. K. D. H.: Stress and the acicular ferrite transformation, *Materials Science and Engineering.*, **A156**, 1992, pp. 1–9.
47. Hono, K., Babu, S. S., Hiraga, K., Okano, R. and Sakurai, T.: Early stage phase decomposition of Al–7.8 at.% Li alloy studied by APFIM, *Acta. Metall. Mater.*, **40**, 1992, pp. 3027–3034.

1991

48. Babu, S. S., Bhadeshia, H. K. D. H. and Svensson, L.-E.: Crystallographic texture and the austenite grain structure of low-alloy steel weld deposits, *Journal of Materials Science Letters*, **10**, 1991, pp. 142–144.
49. Babu, S. S. and Bhadeshia, H. K. D. H.: A direct study of grain boundary allotriomorphic ferrite crystallography, *Materials Science and Engineering*, **A142**, 1991, pp. 209–219.
50. Babu, S. S. and Bhadeshia, H. K. D. H.: Mechanism of the transition from bainite to acicular ferrite, *Materials Transactions, Japan Institute of Metals*, (special issue on Bainite), **32** (8), 1991, pp. 679–688.

1990

51. Babu, S. S. and Bhadeshia, H. K. D. H.[†] The transition from bainite to acicular ferrite in reheated Fe–Cr–C weld deposits, *Materials Science and Technology*, **6**, 1990, pp. 1005–1020.

Conference Proceedings

2003

2002

1. Babu, S. S., Elmer, J. W., David, S. A., and Quintana, M. A., “Nonequilibrium solidification in Fe-C-Al-Mn steel welds,” submitted for publication in proceedings of International Conference on Trends in Welding Research, Pine Mountain, Georgia, 2002.
2. Palmer, T. A., Elmer, J. W., Wong, J., Babu, S. S., and Vitek, J. M., “Investigation of the Kinetics of the Ferrite/Austenite Phase Transformation in the HAZ of a 2205 Duplex Stainless Steel Weldment,” submitted for publication in proceedings of International Conference on Trends in Welding Research, Pine Mountain, Georgia, 2002.

2001

3. M.K. Miller and S.S. Babu, "Atomic Level Characterization of Precipitation in Alloy 718," *Superalloys 718, 625, 706 and Various Derivatives*, Ed. E. A. Loria, (Warrendale, PA: TMS, 2001), pp. 357-365.

2000

4. Babu, S. S., David, S. A., Vitek, J. M., and Miller, M. K., “Precipitation of \square from \square during the weld thermal cycle: Recent results of APFIM characterization and modeling,” *Proc. Of Advanced Technologies for Superalloy Affordability*, Nashville, Tennessee, USA, 2000, page 83.

[†] Pheil Medal and prize for the research paper of particular merit in the field of physical metallurgy for the previous two years, published by the Institute of Metals, London.

5. Miller, M. K. and Babu, S. S., "Phase composition in Alloy 718: A Comparison between APT/APFI measurements and thermodynamic predictions," Proc. Of Advanced Technologies for Superalloy Affordability, Nashville, Tennessee, USA, 2000, page 63.
6. David, S.A., Vitek, J. M., Babu, S. S., Welding of nickel base superalloy single crystals, proceedings of "Welding and Repair - Technology for power Plants" June 7-9, 2000 held at Naples, Florida.
7. Babu, S. S., Vitek, J. M., and David, S. A., Prediction of heat-treatment effects using computational thermodynamic and kinetic models, Proceedings of HTS-Show 2000, St. Louis, 2000.
8. Martukanitz, R. P., Parks, K. D., Babu, S. S., David, S. A., "Analysis of hard particle retention in laser melt pools," Proceedings of the International Congress on Applications of Lasers and Electro-Optics, October 2-5, Dearborn, MI, 2000

1999

9. Babu, S.S., David, S. A., Hong, T., and DebRoy, T.: Effect of fluid flow on inclusion coarsening in low-alloy steels welds, Proceedings on Fluid Flow Phenomena in Metals Processing, Eds. N.El-Kaddah, and D. G. C. Robertson, S. T. Johansen, and V.R. Voller, The Minerals, Metals, and Materials Society, 1999, page 221
10. Babu S. S., David, S. A., and Vitek, J. M.: "Thermo-Chemical-Mechanical Effects on Microstructure Development in Low Alloy Steel Welds," Proc. of an International Conference on "Solid to Solid Phase Transformations 99," Kyoto, Japan, 1999, page 1565
11. Vitek, J. M., Iskander, Y. S., Oblow, E. M., Babu, S. S. David, S. A., Fuerschbach, P., and Smartt, H.: Neural net model for weld pool shape in aluminum pulsed laser welds, Proc. Intl. Conference on Trends in Welding Research, Pine Mountain, Georgia, 1-5 (1999), ASM International, page 119
12. Babu, S. S., David, S. A., and DebRoy, T.: Inclusion formation in low-alloy steel welds, Proc. Intl. Conference on Trends in Welding Research, Pine Mountain, Georgia, 1-5 (1999), ASM International, page 179
13. Babu, S. S., David, S. A., Vitek, J. M., and Miller, M. K.: Atom probe field-ion microscopy investigation of Ni-base superalloy welds, Proc. Intl. Conference on Trends in Welding Research, Pine Mountain, Georgia, 1-5 (1999), ASM International, page 239
14. Vitek, J. M., Iskander, Y. S., Oblow, E. M., Babu, S. S. and David, S. A.: Neural net model for predicting ferrite number in austenitic stainless steel welds, Proc. Intl. Conference on Trends in Welding Research, Pine Mountain, Georgia, 1-5 (1999), ASM International, page 442
15. Feng, Z., Gould, J. E., Babu, S. S., Santella, M. L., and Riemer, B.: An incrementally coupled electrical-thermal-mechanical model for resistance spot welding, Proc. Intl. Conference on Trends in Welding Research, Pine Mountain, Georgia, 1-5 (1999), ASM International, page 599
16. Santella, M. L., Babu, S. S., Riemer, B., and Feng, Z.: Microstructure development in resistance-spot steel welds, Proc. Intl. Conference on Trends in

- Welding Research, Pine Mountain, Georgia, 1-5 (1999), ASM International, page 605
17. van der Eijk, C., Grong, Ø., Babu, S. S., and David, S. A.: Effects of interactive particles on steel weldability, Proc. Intl. Conference on Trends in Welding Research, Pine Mountain, Georgia, 1-5 (1999), ASM International, page 729.
 18. Babu, S.S., David, S. A., Vitek, J. M., and Miller, M. K.: Characterization and Modeling of Microstructure Development in Nickel-base Superalloy Welds, accepted for publication in Proc of second International conference on Joining of Advanced and Specialty Materials, 1999.

1998

19. Babu, S. S., Riemer, B. W., Santella, M. L., and Feng, Z.: Integrated thermal-microstructure model to predict the property gradients in resistance spot steel welds, Proc. of Sheet Metal Welding Conference VIII, Paper #5-2, Detroit, MI, Oct 13-16, 1998.
20. Feng, Z., Babu, S. S., Santella, M. L., Riemer, B. W., and Gould, J. E.: Modeling of Resistance Spot Welding, Proceedings of Taiwan International Welding Conference '98, Sept 7-9, 1998 Taipei, Taiwan (eds. C. L. Tsai and H. L. Tsai), p 235-240

1997

21. David, S. A., Babu, S. S., and Vitek, J. M.: Weldability and microstructure development in nickel-base superalloys, Proc. Intl. Conference on Numerical Analysis of Weldability - V, Graz, Austria, 1997.

1996

22. David, S. A., and Babu, S. S., and Vitek, J. M.: Trends in Microstructure Modeling in Weld Metals, Trans. JWRI, 1996, 25, 127-143. (Proc. International Symposium on Theoretical Prediction in Joining and Welding, Joining and Welding Research Institute, Osaka University, Ibaraki, Osaka, Japan, November, 1996)

1995

23. David, S. A., and Babu, S. S.: Microstructure modeling in weld metal, Proc. International Conference on Numerical Analysis of Weldability, Graz-Saggau, Austria, 25-27 September, 1995 (published as monograph by Institute of Materials, London, UK).
24. Babu, S. S., David, S. A., Vitek, J. M., and DebRoy, T.: Phase Transformations and Microstructure Development in low alloy steel welds, Proceedings of an International Symposium on Phase Transformations during the Thermal / Mechanical Processing of Steel, Canada, 1995.
25. Babu, S. S., David, S. A., Vitek, J. M., Mundra, K., and DebRoy, T.: Modeling the formation of non-metallic oxide inclusions in low alloy steel fusion welds, Proc. 4th Intl. Conf. on "Trends in Welding Research," Gatlinburg, TN, USA, 1995.

26. Babu, S. S., David, S. A., and Vitek, J. M.: Effect of oxide inclusions on the solid state transformations in low alloy steel fusion welds, Proc. of 4th Intl. Conf. on "Trends in Welding Research," Gatlinburg, TN, USA, 1995.
27. Mundra, K., DebRoy, T., Babu, S. S., and David, S. A.: Microstructure evolution in low alloy steel weld metal from convective heat transfer calculations in three dimensions, Proc. of 4th Intl. Conf. on "Trends in Welding Research," Gatlinburg, TN, USA, 1995.
28. Mundra, K., DebRoy, T., Babu, S. S., David, S. A., and Paul, A. J.: Towards predicting weld metal microstructure from fundamentals of transport phenomena, Proc. International Conference in Modeling of Casting, Welding and Advanced Solidification Processes VII, 1995.
29. David, S. A., and Babu, S. S., and Vitek, J. M.: Advances in Welding Science and Technology, Proceedings of the International workshop on recent trends in welding, Bangalore, India, October 1995.

1994

30. Babu, S. S., David, S. A., Vitek, J. M., and DebRoy, T.: The effect of oxide inclusions on kinetics of austenite to ferrite transformation in low alloy steel weld metal, Proc. International Conference on *Solid → Solid phase transformations in inorganic materials*, 1994, pp. 213- 218.
31. David, S. A., Vitek, S. A., Babu, S. S. and DebRoy, T.: Advances in Welding Science - A Perspective, Proc. of 42nd National Welding Conference, Melbourne, Australia, Vol. 2, Welding Technology Institute of Australia, Silverwater, New South Wales, Australia, 1994.

1988

32. Babu, S. S., Rajasekhar, M. V., and Achar, D. R. G.: Studies on improving aluminum zinc magnesium alloy weld metal properties, presented at the international conference on *Welding technology in developing countries – present status and future needs*, Organized by University of Roorkee, INDIA, 1988.

Other Publications

1. Babu, S. S., Vitek, J. M., and David, S. A., Microstructure modeling of heat-affected-zone and Fusion zone in welds, invited article for McGraw Hill Encyclopedia of Science and Technology, 2000.
2. Elmer, J. W., Palmer, T. A., Babu, S. S., Synchrotron radiation analyzes steel welds, *Advanced Materials and Processes*, 2002, **160**, 23-26.

Invited Talks

1. Babu, S. S., Hono, K. and Sakurai, T., APFIM characterization of metallic materials," invited talk at Japanese Welding Society, Sendai, Japan, Nov., 1992.
2. Babu, S. S., Hono, K. and Sakurai, T., "Nanoscale compositional analysis of materials by atom probe field ion microscope," invited talk at NTT basic sciences research laboratory, Ibaraki, Japan, Nov., 1992.
3. Babu, S. S.: Phase Transformations and Modeling of Microstructure Development in Low Alloy Steel Welds, ASM-IIM India invited lecture at IIT Madras, India, June 1997
4. Babu, S. S.: Phase Transformations and Modeling of Microstructure Development in Low Alloy Steel Welds, ASM-IIM India invited lecture at IGCAR, Kalpakkam, India, June 1997.
5. Babu, S. S. : Atom probe field ion microscopy of single crystal Ni-base superalloy welds,, ASM-IIM India invited lecture at Indian Institute of Science, Bangalore, June 1997.
6. Babu S. S.: Fundamental understanding of inclusion formation and microstructural evolution in low-alloy steel welds, invited talk at Nippon Steel Corporation, June, 1999
7. Babu S. S.: Fundamental understanding of inclusion formation and microstructural evolution in low-alloy steel welds, invited talk at National Research Institute for Metals, June, 1999
8. Babu S. S.: Modeling and characterization of microstructure development in structural alloy welds; Invited seminar at Materials Science and Engineering Department, Virginia Polytechnic Institute and State University on August, 1999.
9. Babu, S. S., David, S. A., and Miller, M. K., "Application of atom probe microanalysis for understanding microstructure evolution in nickel base superalloy welds," invited talk at Phase Transformations Symposium, Microscopy and Microanalysis Meeting 2000, Philadelphia, 2000.
10. Babu, S. S., and David, S. A. "inclusion formation in steel welds," invited talk at work shop on laser induced surface alloying" Applied Research Laboratory, State College. PA. August 2000.
11. S. S. Babu, J. M. Vitek, M. K. Miller, and S. A. David, "Nonequilibrium microstructure evolution in nickel base superalloys," invited talk at High Temperature Materials 2001 symposium held at National Research Institute for Materials Science (NIMS) at Tsukuba science city, Japan, June 2001
12. S. S. Babu, "Nonequilibrium solidification in a Fe-C-Al-Mn Low-Alloy steel weld: Time-Resolved X-ray diffraction study, Invited talk at Lawrence Livermore National Laboratory, Livermore, California, July 2002.
13. S. S. Babu, "Metallurgical and Microstructural Features of Heat Treating by Induction, " Invited talk at Inductoheat annual meeting at Florida, October 2001
14. S. S. Babu, "Nonequilibrium solidification in a Fe-C-Al-Mn Low-Alloy steel weld: Time-Resolved X-ray diffraction study, Invited talk at Virginia Tech, February 2002.

15. S. S. Babu, "Inclusion formation and microstructure evolution in low alloy steel welds," invited lecture in International Conference on Advanced Structural Steels (ICASS 2002) held at Tsukuba, Japan, May 2002.
16. S. S. Babu, "Real time synchrotron diffraction of steel weld as it solidifies," invited seminar at University of Cambridge, UK, November 2002
17. S. S. Babu, "Joining of nickel base superalloy single crystals," invited seminar at at International Conference on Microstructure and Performance of Joints in High-Temperature Alloys, London 2002, being considered for publication in *Science and Technology of Welding and Joining*, 2002

Conference Presentations

1. Babu, S. S. and Bhadeshia, H. K. D. H., "Stress and the Acicular Ferrite Formation," presentation at the JIM Annual Meeting, Tokyo, April, 1992.
2. Babu, S. S., Hono, K. and Sakurai, T., "APFIM studies on martensite tempering of Fe-C-Si-Mn low alloy steel," presentation at International Field Emission Symposium, Halifax, Canada, Aug., 1992.
3. Babu, S. S., Hono, K. and Sakurai, T., "APFIM study of redistribution of alloying elements during martensite tempering of a low alloy steel" presented in the spring meeting of Japan Institute of Metals, Toyama, Japan, Oct., 1992.
4. Babu, S. S., David, S. A., Vitek, J. M., and DebRoy, T., "The effect of oxide inclusions on kinetics of austenite to ferrite transformation in low alloy steel weld metal," presentation at the international conference on *Solid → solid phase transformations in inorganic materials*, Pittsburgh, USA, July, 1994.
5. Babu, S. S., David, S. A., Vitek, J. M., and Miller, M. K.: Atom probe field ion microscopy of type 308 CRE stainless steel welds, presented in 76th American Welding Convention, Ohio, 3 April, 1995.
6. Babu, S. S., David, S. A., Vitek, J. M., Mundra, K., and DebRoy, T.: Non-Metallic oxide inclusion formation in low alloy steel welds, presented in 76th American Welding Convention, Cleveland, Ohio, 5 April, 1995.
7. Babu, S. S., David, S. A., Vitek, J. M., Mundra, K., and DebRoy, T.: Modeling the formation of non-metallic oxide inclusions in low alloy steel fusion welds, presented in 4th Intl. Conf. on "Trends in Welding Research," Gatlinburg, TN, USA, 1995.
8. Babu, S. S., David, S. A., and Vitek, J. M.: Effect of oxide inclusions on the solid state transformations in low alloy steel fusion welds, presented in 4th Intl. Conf. on "Trends in Welding Research," Gatlinburg, TN, USA, 1995..
9. Babu, S. S., Vitek, J. M., David, S. A., Mundra, K., and DebRoy, T.: Model for inclusion formation in low alloy steel welds, presented in 77th American Welding Convention, Chicago, Illinois, 24 April, 1996.
10. Babu, S. S., David, S. A., and DebRoy, T.: Effect of fluid flow on coarsening in low-alloy steel welds, presented in 78th American Welding Society Convention, Los Angeles, California, April 1997.
11. Babu, S. S., David, S. A., Vitek, J. M., and Miller, M. K.: Atom probe field ion microscopy of single crystal Ni-base superalloy welds, presented in 78th American Welding Society Convention, Los Angeles, California, April 1997
12. Babu S. S., Reidenbach, F., David, S. A., Böllinghaus, T., and Hoffmeister, H.: Effect of high energy density welding processes on inclusion and microstructure formation in low alloy steel welds, presented in 79th American Welding Society Convention, Detroit, Michigan, April 1998.

13. Babu, S. S., David, S. A, Clark, M. D. and Edwards G. R: Inclusion and microstructure evolution in high strength steel welds, presented in 79th American Welding Society Convention, Detroit, Michigan,, April 1998.
14. Babu, S. S., David, S. A., and DebRoy, T.: Inclusion formation in low-alloy steel welds, presented at Intl. Conference on Trends in Welding Research, Pine Mountain, Georgia, 1-5 June 1998.
15. Babu, S. S., David, S. A., Vitek, J. M., and Miller, M. K.: Atom probe field-ion microscopy investigation of Ni-base superalloy welds, presented at Intl. Conference on Trends in Welding Research, Pine Mountain, Georgia, 1-5 June 1998.
16. Babu, S. S., David, S. A, and Evans, G. M.: Inclusions and microstructure formation in titanium containing low alloy steel welds, presented in 80th American Welding Society Convention, St. Louis, Missouri, April 1999.
17. Babu, S. S., David, S. A, Vitek, J. M., and Reed, R. W.: Characterization and modeling of microstructure development in aluminum alloy welds, presented in 80th American Welding Society Convention, St. Louis, Missouri, April 1999.
18. Babu, S. S., David, S. A., Quintana, M., and McLane, J.: Microstructure development in self-shielded flux cored arc welds, presented in 80th American Welding Society Convention, St. Louis, Missouri, April 1999.
19. Babu, S. S., Riemer, B. W., Santella, M. L., and Feng, Z.: Integrated thermal-microstructure model to predict the property gradients in resistance spot steel welds, presented at Sheet Metal Welding Conference VIII, Paper #5-2, Detroit, MI, Oct 13-16, 1998.
20. Babu S. S.: Use of APFIM and the importance of thermodynamic and kinetic modeling techniques for studying non-equilibrium partitioning in Ni-base superalloy welds, workshop on Microscopy and Microanalysis for Phase Transformation Studies, May 30 - June 1, 1999, at Hotel Uminonakamichi, Fukuoka, Japan.
21. Babu S. S., David, S. A., and Vitek, J. M.: "Thermo-Chemical-Mechanical Effects on Microstructure Development in Low Alloy Steel Welds," presented in an International Conference on "Solid to Solid Phase Transformations 99," Kyoto, Japan, 1999.
22. Babu S. S., David, S. A., Vitek, J. M., and Miller M. K.: Characterization and Modeling of Microstructure Development in Nickel-base Superalloy Welds, of second International conference on Joining of Advanced and Specialty Materials, 1999.
23. Babu, S. S., David, S. A., Vitek, J. M., and Miller, M. K., "Precipitation of γ from δ during the weld thermal cycle: Recent results of APFIM characterization and modeling," Advanced Technologies for Superalloy Affordability Conference, Nashville, Tennessee, USA, 2000.
24. Babu, S. S., Vitek, J. M., and David, S. A., Prediction of heat-treatment effects using computational thermodynamic and kinetic models, presented at HTS-Show 2000, St. Louis, October, 2000.
25. Babu, S. S., Integrated Process Modeling of Resistance Spot Welds, Invited Talk, Departamento de Ciencia dos Materiais e Metalurgia (Department of Materials Science and Metallurgy) at Pontificia Universidade Catolica Do Rio de Janeiro (PUC-Rio), March, 2001
26. David, S. A., and Babu, S. S. Nickel base superalloy welding, Invited Talk, Departamento de Ciencia dos Materiais e Metalurgia (Department of Materials Science and Metallurgy) at Pontificia Universidade Catolica Do Rio de Janeiro (PUC-Rio), April, 2001
27. S. S. Babu, J. W. Elmer, S. A. David, M. Quintana, "In-stu TRXRD observation of microstructure development in self-shielded flux cored arc weld deposits," MAX International, Cleveland, May, 2001.

28. S. S. Babu, J. W. Elmer, S. A. David and M. A. Quintana, "Nonequilibrium solidification in a Fe-C-Al-Mn Low-Alloy steel weld: Time-Resolved X-ray diffraction study using Synchrotron Radiation, MAX International, Chicago, March, 2002.