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Nanocrystalline alloys for remarkable oxidation resistance

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Abstract

This presentation will demonstrate remarkable resistance to oxidation as result of the nanocrystalline alloy structure. This will include an elaborate description of the author's own hypothesis that nanocrystalline structure can impart extraordinary oxidation resistance, and the validation of this hypothesis. A thorough surface/subsurface characterization of oxidized alloys, using secondary ion mass spectrometry has provided a sound mechanistic understanding of the remarkable improvement in oxidation as result of nanocrystalline structure. The data to be presented will include the results establishing that a Fe-Cr nanocrystalline alloy with only 10wt% Cr can provide as much oxidation resistance as a Fe-20Cr alloy, suggesting possibility of Fe-Cr alloys with the necessary corrosion resistance at much lower Cr contents. As another exciting potential application of this work, the nanocrystalline powders of Fe-Cr alloys synthesized in this study could be used for developing corrosion resistance coating having considerably low Cr contents.

Biography:

Professor Raman Singh has a joint appointment as a full professor at the Dept of Chemical Engineering and Dept of Mechanical & Aerospace Engineering, Faculty of Engineering, Monash University (Melbourne, Australia). He is also a Research Professor at Centre for Clean Energy Engineering at University of Connecticut (USA). His primary research interests are in the relationship of Nano-/microstructure and Environment-assisted degradation and fracture, and Nanotechnology for Advanced Mitigation of such Degradations. He has also worked extensively on use of advanced materials (e.g., graphene) for corrosion mitigation, stress corrosion cracking, and corrosion and corrosion-mitigation of magnesium alloys (including for the use of magnesium alloys for aerospace, defence and bioimplant applications).

Prof Singh's professional distinctions and recognitions include: editor of a book on cracking of welds, member the Editorial/ Review Boards of a few journals (including the prestigious, Metallurgical & Materials Transactions of ASM, USA), leader/co-chairman of a few international conferences and regular keynote/invited lectures at international conferences, over 135 peer-reviewed international journal publications, 15 book chapters/books and over 100 reviewed conference publications, and several competitive research grants totaling over $8M (that includes 3 Discovery, and 8 Linkage grants of Australian Research Council). Professor Singh had research training/employment at Indian Institute of Technology (Kharagpur), Indian Atomic Energy and University of New South Wales (Sydney).

Prof Singh has supervised over thirty PhD students. His vibrant research group at Monash University comprises of PhD students from different disciplines (Mechanical, Chemical, Materials and Mining Engineering, and Science) as well as from different cultural backgrounds (Australian, Middle-eastern, Chinese, Malaysian, Indian, African, North American and Israeli).