MONASH University

Staff Profile
Department of Materials Engineering

Christopher Hutchinson

Senior Lecturer

BEng Monash University 1996
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RESEARCH INTERESTS

My research is focused on two principle areas: i) the thermodynamics and kinetics of phase transformations and microstructural changes in the metallic solid state, and ii) the relationship between mechanical properties and microstructure of metals and alloys. This work contains both experimental and theoretical components with an emphasis on model development at the mesoscale.

My current research activities can be classified under three topics:

Recovery, Recrystallization and Grain Growth

- The effects of solute and precipitates on static and dynamic recrystallization processes in Fe, Mg and Cu based systems.
- The effect of recovery on the nucleation of recrystallization

Phase Transformations

- Thermodynamics and kinetics of atomic clustering processes in Al and Mg alloys
- Effects of solute on the kinetics of the austenite to ferrite transformation in Fe-C-X alloys
- The design of non-isothermal heat treatment schedules for precipitation hardening systems

Mechanical Properties

- Solute and Precipitate Effects on the Work Hardening of Al Alloys
- Strength-Elongation combinations in inhomogeneous solid solutions
- Solute and Precipitate Effects on the creep and fatigue properties of Al alloys

More recent evolving areas of research include the coupling of microstructure and corrosion in engineering alloys and the thermodynamics and kinetics of phase selection during the devitrification of metallic glasses for hard magnetic applications.

SELECTED PUBLICATIONS

1. **C. R. Hutchinson,** M. Goune and A. Redjaimia**,** "Selecting Non-Isothermal Heat Treatment Schedules for Precipitation Hardening Systems: An Example of Coupled Process-Property Design", *Acta Materialia*, 55, pp. 213-223, 2007.

2. Y. Brechet and **C. R. Hutchinson**, "Defect-Induced Solid State Patterning in Metals and Alloys*", Solid State Physics: Advances in Research and Applications*, 60, pp. 181-287, 2006.

3. C. Mendis, C. J. Bettles, M.A. Gibson and **C. R. Hutchinson**, "An Enhanced Age Hardening Response in Mg-Sn Based Alloys Containing Zn", *Materials Science & Engineering A*, 435-436, pp. 163-171, 2006.

4. C. Mendis, C. Bettles, M. Gibson, S. Gorsse and **C. R. Hutchinson**, "The Refinement of Precipitate Distributions in a Mg-Sn Alloy Through Microalloying", *Philosophical Magazine Letters*, 86, pp. 443-456, 2006.

5. **C. R. Hutchinson**, H. S. Zurob and Y. Brechet, "The Growth of Ferrite in Fe-C-X Alloys: The Role of Thermodynamics, Diffusion and Interfacial Conditions", *Metallurgical and Materials Transactions A*, pp. 1711-1720, 2006.

6. H.S. Zurob, G. Zhu, S. V. Subramanian, G. R. Purdy, **C. R. Hutchinson** and Y. Brechet, "Analysis of the Effect of Mn on the Recrystallization Kinetics of High Nb Steel: An Example of Physically Based Alloy Design", *ISIJ*, 45, pp. 714-723, 2005.

7. **C. R. Hutchinson**, J.-F Nie and S. Gorsse "Modeling the Precipitation Processes and Strengthening Mechanisms in an Mg-Al-(Zn) AZ91 Alloy", *Metallurgical and Materials Transactions A,* 36A, pp. 2093-2105 2005.

8. S. Gorsse, **C. R. Hutchinson**, B. Chevalier and J. F. Nie, "A Thermodynamic Assessment of the Mg-Nd System Using Random and Associate Models for the Liquid Phase" *Journal of Alloys and Compounds,* 392, pp. 253-262, 2005.

9. H. S. Zurob, **C. R. Hutchinson**, G. R. Purdy and Y. Bréchet, "Rationalization of the Softening and Recrystallization Behaviour of Microalloyed Austenite Using Mechanism Maps", *Materials Science & Engineering A*, 382, 1-2, pp. 64-81, 2004.

10. **C. R. Hutchinson,** R. E. Hackenberg and G. J. Shiflet, "The Growth of Partitioned Pearlite in Fe-C-Mn Steels", *Acta Materialia*, 52, pp. 3565-3585, 2004.

11. **C. R. Hutchinson**, A. Fuchsmann and Y. Brechet, "The Diffusional Formation of Ferrite from Austenite in Fe-C-Ni Alloys", *Metallurgical and Materials Transactions A*, 35A, pp. 1211-1221, 2004.

A. Phillion, H. S. Zurob, **C. R. Hutchinson**, H. Gao, D. V. Malakhov, J. Nakano**,** and G. Purdy., "Studies of the Influence of Alloying Elements on the Growth of Ferrite from Austenite under Decarburisation Conditions: Fe-C-Ni", *Metallurgical and Materials Transactions A*, 35A, pp. 1237-1242, 2004.

B. **R. Hutchinson** and G. J. Shiflet, "The Formation of Pearlite above the Upper Ae1 in an Fe-C-Mn Steel", *Scripta Materialia*, 50, pp. 1-5, 2004.

C. **R. Hutchinson**, A. Fuchsmann, H. S. Zurob and Y. Brechet, "A Novel Experimental Approach to Identifying Kinetic Transitions in Solid State Phase Transformations", *Scripta Materialia*, 50, 285-290, 2004.

12. K. Raviprasad, **C. R. Hutchinson,** T. Sakurai and S. P. Ringer, "The Effect of Trace Additions of Ag and Si on the Precipitation Processes in Al-Cu-Mg Alloys", *Acta Materialia*, 51, pp. 5037-5050, 2003.

13. **C. R. Hutchinson** and Y. Brechet, "Solute Drag: A review of the 'Force' and 'Dissipation' approaches to the effect of solute on grain and interphase boundary motion", in 'Thermodynamics, Microstructure and Plasticity', Eds. A Finel, D. Mazière and M. Veron, NATO Science Series, vol. 108, pp. 155-164, 2003.

14. H. S. Zurob, **C. R. Hutchinson**, Y. Brechet and G. Purdy, "Modelling Recrystallisation of Microalloyed Austenite: effect of coupling recovery, recrystallisation and precipitation.", *Acta Materialia*, 50, pp.3075-3092, 2002.

15. **C. R. Hutchinson**, X. Fan, S. J. Pennycook and G. J. Shiflet., "On the Origin of the High Resistance to Coarsening of Ω Plates in Al-Cu-Mg-Ag Alloys", *Acta Materialia*, 49, pp. 2827-2841, 2001.