Department of Materials Science and Engineering
Massachusetts Institute of Technology
3.14 Physical Metallurgy – Fall 2003

Review Assignment #3

Due Wednesday, December 10, 2003

Three recent research articles have been made available on the course website:

1. C.-Y. Hung, G. Spanos, R.O. Rosenberg, and M.V. Kral, "Three-Dimensional Observations of Proeutectoid Cementite Precipitates at Short Isothermal Transformation Times," *Acta Materialia*, Volume 50, pages 3781–3788 (2002). Although steels have been studied for a long time and are reasonably well understood, the next level of performance can only be achieved by tailoring the microstructure in all three dimensions. This work describes the techniques and issues associated with 3-D understanding of steel microstructures.

2. M. Kouzeli, L. Weber, C. San Marchi, and A. Mortensen, "Quantification of Microdamage Phenomena During Tensile Straining of High Volume Fraction Particle Reinforced Aluminum," *Acta Materialia*, Volume 49, pages 497-505 (2001). This work studies the nucleation of damage (cracks and voids) in an advanced metal-matrix composite material, where the second phase plays a major role in the fracture mechanism.

3. R. Banerjee, P.C. Collins, D. Bhattacharyya, S. Banerjee, and H.L. Fraser, "Microstructural Evolution in Laser Deposited Compositionally Graded α/β Titanium-Vanadium Alloys," *Acta Materialia*, Volume 51, pages 3277-3292 (2003). This article describes a novel approach to the exploration of microstructure in a binary alloy, by grading the composition through a thick slab. The microstructure and crystallography of the α/β phase relations are studied in this "combinatorial" methodology.

Your assignment is to select one of these three articles, read it carefully, and think critically about what you have read. You will then prepare a short review of the article, in about 3 pages. About the first third of your review should be a synopsis of the paper, inclusive of methods and main results. The remainder of the review should offer a critique of the paper, and present some creative thoughts for future questions to be addressed. For example, some things to discuss may include:

• Does anything in this paper contradict the "textbook" knowledge that you are learning in class?
• Are the methods used in the work sufficient to support the conclusions drawn by the authors?
• Is the logic internally consistent? Do all of the data support the same conclusion?
• Can you suggest a better way to resolve one or more of the open questions in this work?
• Is there a simple experiment that can either refute or substantially support the authors' claims?
• How general are the conclusions of this paper; are these results to be expected for other metals or materials?