

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

**Review Assignment #1**

**Due Monday, October 6, 2003**

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

1. T. J. Balk, G. Dehm and E. Arzt, “Parallel glide: unexpected dislocation motion parallel to the substrate in ultrathin copper films”, *Acta Materialia*, Volume 51, Issue 15, Pages 4367-4668 (2003).

This article discusses dislocation activity in thin film materials, relevant to circuitry. It is an experimental work that relies heavily upon electron microscopy.

2. V. Yamakov, D. Wolf, S. R. Phillpot and H. Gleiter, “Dislocation–dislocation and dislocation–twin reactions in nanocrystalline Al by molecular dynamics simulation”, *Acta Materialia*, Volume 51, Issue 14, Pages 3985-4365 (2003).

This article describes large-scale simulations of deformation in nanocrystalline aluminum, with detailed discussion of dislocation nucleation and motion.

3. Roger Smith, D. Christopher, S. D. Kenny, Asta Richter, and Bodo Wolf, “Defect generation and pileup of atoms during nanoindentation of Fe single crystals”, *Physical Review B*, Volume 67, No. 245405 (2003).

This article discusses the issue of dislocation production during the process of ‘nanoindentation’, both through experiment and simulation techniques.

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?
- What doors does this work open for future research?