

# **Carnegie Mellon**

## **Materials Science and Engineering Seminar Series**

**David Srolovitz, Dean**

Department of Materials Science  
Yeshiva University

*“Grain Growth in 3-D: Beyond von Neumann-Mullins”*

**Thursday, February 1, 2007**

**11:00 A.M. Seminar in Singleton Room, Roberts Hall**

The von Neumann-Mullins law is the basis for essentially all modern theories of grain growth. Based only on the assumption that grain boundaries migrate at a velocity proportional to their mean curvature, von Neumann-Mullins showed that the rate of a change of the area of each grain is proportional to its number of sides minus six. This result is beautiful, purely topological, and exact. Unfortunately, it says nothing about the important case of three dimensions, where most materials live. Despite 50 years of work in the materials, physics and mathematics communities, a 3-d solution has never been found. Professor Robert MacPherson (Institute of Advanced Study) and I have recently found the 3-d solution. Like the von Neumann-Mullins original solution, this one is beautiful and exact, but not purely topological. I will present this result, sketch where it comes from, and examine its interpretations and implications. Next, I will show how this result can be used to reproduce von Neumann's 2-d result. Before ending, I will describe the extension of this theory to all dimensions and discuss how to practically compute all of the terms in the new relation.

David Srolovitz, PhD, Dean of Yeshiva College and most recently professor and chair of Princeton University's Department of Mechanical and Aerospace Engineering, was appointed the 10th Dean of Yeshiva College on June 1, 2006. Dr. Srolovitz is president of the Society for Engineering Science, editor of a scientific journal and four books, author of six governmental reports and hundreds of scholarly articles, holder of two patents, and recipient of honors from dozens of professional organizations. He earned his PhD in Materials Science and Engineering from the University of Pennsylvania. His research has been sponsored by the US Department of Energy, Defense Advanced Research Projects Agency, National Institute of Standards and Technology, and Office of Naval Research.