Abstract Submitted
for the MAR08 Meeting of
The American Physical Society

Testing the MacPherson-Srolovitz Theory in Simulations of 3D Grain Growth[1] ANTHONY ROLLETT, FATMA UYAR, SETH WILSON, JASON GRUBER, SUKBIN LEE, Carnegie Mellon University — The theory by MacPherson and Srolovitz provides an exact prediction of the growth rate of individual cells or grains in a space-filling network (microstructure). Testing the predictions of the theory requires measurement of mean width and edge lengths where three cells meet at triple line junctions. This is most easily accomplished in networks that are discretized with a mesh. A Moving Finite Element (MFE) model was used to simulate the evolution (grain growth) over short times of a network discretized on a tetrahedral mesh and growth rates. Volumes, mean widths and edge lengths were measured. The growth rates measured from the simulation were found to be in very good agreement with the predictions of the MacPherson-Srolovitz theory. The results from similar measurements in Monte Carlo and Phase Field models of grain growth will also be reported. In this case, measurement of mean width and edge length is complicated by use of a regular grid to discretize the network on a set of points or voxels. A modified algorithm by Ohser and Mücklich is used to measure mean width. Edge length measurement along triple lines requires conversion of the voxel image to a surface mesh.

[1]This work is supported by the National Science Foundation and by the Office of Naval Research.

Anthony Rollett
Carnegie Mellon University

Date submitted: 14 Dec 2007 Electronic form version 1.4