# NANOHOUR

Wednesday, March 24 , 2010 3:00 pm
Beckman Institute - Room 3269

## Heterogeneity at the Nanoscale - How Microstructural Variations Lead to Unusual Mechanical Behavior in Nanocrystalline Metals


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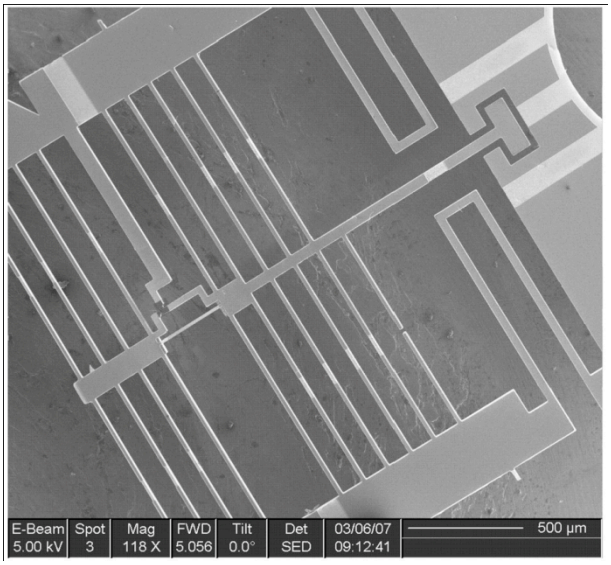
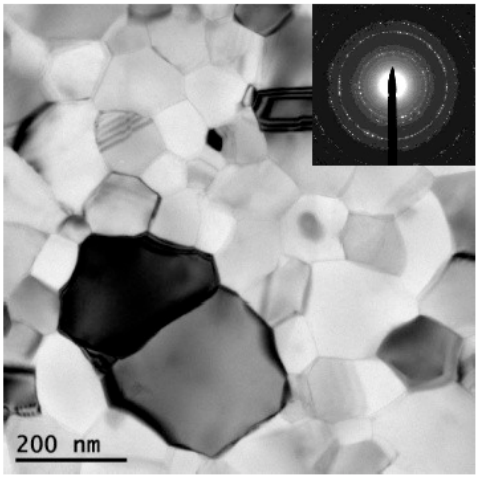
Synthesizing materials that combine high strength and ductility has been a long standing objective of metallurgists and engineers. Very often, metals that exhibit large ductility suffer from low strengths and vice versa. Nanocrystalline metals, which have grain sizes of the order of 100 nm or less, offer the possibility of combining high strength with large deformability and as a result have attracted substantial research interest in recent years. While our understanding of how nanocrystalline metals deform has increased tremendously in the last few years, several questions still remain.

In this talk, I will concentrate on one of the less explored, and consequently less understood, aspects of nanocrystalline metal deformation, namely, the effect of microstructural heterogeneity (for example, variation in the size and orientation of grains) on the mechanical behavior of nanocrystalline metals. In the first part of the talk, I will show that nanocrystalline metals recover a substantial part of plastic deformation after the external force is removed and that in some cases the recovery occurs even before the force is completely removed. This recovery is unexpected since conventionally plastic deformation is considered to be permanent, that is, irrecoverable. In the second part of the talk, I will present results from in situ transmission electron microscopy (TEM) studies which show that this unusual recovery is a direct consequence of the heterogeneity of the microstructure. I will then put forth a simple analysis to show why heterogeneity becomes increasingly important as the microstructural dimensions shrink to the nanoscale. Finally, I will briefly discuss the implications of these results on the use of nanocrystalline metals for practical applications.




**Coffee and cookies will be served**
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