Institute Interest Seminar Series

July 24, 2013

The effect of hydrogen on the microstructure evolution in metals during high pressure torsion and rolling contact fatigue

Megan Emigh

Graduate work: Abstract

In failed, hydrogen-charged metals which are sensitive to hydrogen effects, the underlying microstructure does not evolve in a classical manner. Instead, highly refined nano-scale structures are developed. Recent experimental results have challenged previously proposed hydrogen embrittlement mechanisms by suggesting that it is the evolved microstructure and the concomitant redistribution of hydrogen that dictates the fracture path and mechanism. My research thus far is preparing to examine highly strained materials using high pressure torsion. By contrasting the behavior of the microstructure in hydrogen-charged and uncharged 99.99% Ni, 316 steel, and 316L steel without further complicating the microstructure by introducing the effects of failure, I hope to be able to contrast the behavior of the microstructure under extremely high strains with and without hydrogen.

Hydrogen embrittlement also has a deleterious effect on the life of specimens which are subject to rolling contact fatigue such as ball bearings. Specimens with high hydrogen content have demonstrated flaking failure as well as a concomitant change in microstructure which is characterized by 'white' structures along which fatigue cracks propagated. These white structures, as well as the change in microstructure with respect to depth, will be examined at the nano scale.

Observation of all of these specimens will occur predominately via Transmission Electron Microscopy to observe dislocations. Specimens will be prepared via Focused Ion Beam liftout technique.