

## **Transmission Electron Microscope Investigation of Rolled Nanoscale Multilayers**

Multilayer metal laminates have been used throughout the ages to create high strength and high hardness materials, with the Damascus-patterned sword being one of the most common applications. The research presented in this poster is a microstructural characterization, specifically from the transmission electron microscope (TEM), of Damascus-patterned low carbon steel and Cu-30Zn brass laminates. Initial microstructural characterization of these laminates was done in the scanning electron microscope (SEM) by Dr. Ravi Chandran from the University of Utah. The goal of this research is to gain a deeper understanding of the microstructure of the laminates on the nano-scale and link those microstructural findings to the strength and hardness results presented by Dr. Chandran. The laminates were prepared through extensive cold rolling, were deformed to a maximum reduction of 99.97% of the initial thickness and were annealed at 400°C. Specimens for the TEM were prepared using the Fischione Model 2000 Sample Preparation System and photos of the microstructure were taken using the JEOL 2000FX TEM. Some areas of the specimens experienced dynamic recrystallization. Other areas showed significant texture. Additionally, breakdown of the layer structure was observed in some regions, most likely resulting from the extensive work of deformation induced by cold rolling. Future work includes additional characterization with SEM along with ion channeling contrast using focused ion beam microscopy as well as the use of electron dispersive spectroscopy to more accurately differentiate which layers are becoming recrystallized.