

## **IN-SITU NEUTRON DIFFRACTION STUDIES OF DEFORMATION-INDUCED PHASE TRANSFORMATION IN AN ULTRAFINE GRAINED TRIP STEEL**

Hahn Choo<sup>1,2</sup>, Kaixiang Tao<sup>1</sup>, Bjorn Clausen<sup>3</sup>, Jae-Eun Jin<sup>4</sup>, and Young-Kook Lee<sup>4</sup>

1. Materials Science and Engineering, University of Tennessee, Knoxville, TN 37996
2. Materials Science and Technology, Oak Ridge National Laboratory, Oak Ridge, TN 37831
3. Los Alamos Neutron Science Center, Los Alamos National Laboratory, Los Alamos, New Mexico 87545
4. Department of Metallurgical Engineering, Yonsei University, Seoul, 120-749, Republic of Korea

Recent advances in the severe-plastic-deformation (SPD) techniques allow the grain refinement of structural alloys to the nanoscale, resulting in a tremendous increase in the strength. However, the high yield strength of the ultrafine-grained (UFG) alloy is usually achieved at the expense of the ductility due to the lack of strain hardening.

In this talk, we will present that deformation-induced martensitic phase transformation can be an effective source of strain hardening in an ultrafine-grained (UFG) steel. The tensile testing of the UFG steel (average grain size of about 0.3  $\mu\text{m}$ ) at ambient temperature shows a three-fold increase in the yield strength compared to its coarse-grained (50  $\mu\text{m}$ ) counterpart. More importantly, the increase in the strength was achieved without the sacrifice of the ductility. The evolution of phase strains and phase fractions of the austenite and martensite phases during the deformation was investigated using in-situ neutron diffraction. The neutron results are correlated to the macroscopic tensile behavior to provide a micromechanical understanding of the transformation-induced plasticity (TRIP) responsible for the combination of high strength and ductility observed in the UFG TRIP steel.