Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

X-Ray Speckle Measurements of Hysteresis in a Shape Memory Alloy MICHAEL ROGERS, Department of Physics, University of Ottawa, MARK SUTTON, Department of Physics, McGill University — Shape memory alloys (SMAs), such as the ternary alloy CuAlNi, are metals that have the fascinating ability to "remember" their original shape: Once deformed, the simple act of heating can thermomechanically return them to their original configuration. At the heart of this process is a martensitic phase transition, a solid-solid transition that can be induced by either a temperature change or by external stress. Cycling between phases of SMAs reveals hysteresis in their stress-strain relationships and transformation temperatures. Moreover, these characteristics evolve over many transformation cycles. We report on in-situ X-ray Photon Correlation Spectroscopy (XPCS) measurements of the microstructural evolution of a CuAlNi alloy that underlies these hysteresis effects. By simultaneously monitoring changes in X-ray speckle patterns from the two solid phases as the alloy was thermally cycled through both partial and full transformations, we have seen reversible microstructural hysteresis loops and irreversible loops that reveal mesoscopic plastic deformation in the material.

Michael Rogers
Department of Physics, University of Ottawa

Date submitted: 14 Nov 2014 Electronic form version 1.4