Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Evidence of Fatigue Damage in the Local Structure of Zr-based Bulk Metallic Glasses DESPINA LOUCA, PENG TONG, University of Virginia, PETER LIAW, GONGYAO WANG, The University of Tennessee, YOSHIHIKO YOKOYAMA, Tohoku University, ANNA LLOBET, Los Alamos National Laboratory, RICK SPENCE, Argonne National Laboratory — Bulk metallic glasses (BMG) are particularly vulnerable to fatigue damage, where catastrophic failure may occur without observable macroscopic changes. The local atomic structure of two BMGs with compositions of $Zr_{50}Cu_{40}Al_{10}$ and $Zr_{60}Cu_{30}Al_{10}$was investigated by synchrotron X-ray and neutron diffraction via the pair density function analysis. Under a load of 1600 MPa, the number of compression cycles ranged from 0 – 10^7 at 10 Hz. At room temperature, a subtle but irreversible change is observed in the local structure due to fatigue. Upon cooling down to 10 K, however, a significant structural re-organization is observed especially in the short range that is proportional to the number of fatigue cycles. The effect becomes more pronounced with increasing the number of loading cycles. The changes are beyond the usual narrowing from reducing thermal vibrations. The results indicate that hardening occurs after fatigue.

Despina Louca
Department of Physics, University of Virginia

Date submitted: 19 Nov 2010 Electronic form version 1.4