Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Mechanical Properties of Stable Glasses Using Nanoindentation[1]

SARAH WOLF, TIANYI LIU, YIJIE JIANG, KEYUME ABLAJAN, YUE ZHANG, PATRICK WALSH, KEVIN TURNER, ZAHRA FAKHRAAI, University of Pennsylvania — Glasses with enhanced stability over ordinary, liquid quenched glasses have been formed via the process of Physical Vapor Deposition (PVD) by using a sufficiently slow deposition rate and a substrate temperature slightly below the glass transition temperature. These stable glasses have been shown to exhibit higher density, lower enthalpy, and better kinetic stability over ordinary glass, and are typically optically birefringent, due to packing and orientational anisotropy. Given these exceptional properties, it is of interest to further investigate how the properties of stable glasses compare to those of ordinary glass. In particular, the mechanical properties of stable glasses remain relatively under-investigated. While the speed of sound and elastic moduli have been shown to increase with increased stability, little is known about their hardness and fracture toughness compared to ordinary glasses. In this study, glasses of 9-(3,5-di(naphthalen-1-yl)phenyl)anthracene were deposited at varying temperatures relative to their glass transition temperature, and their mechanical properties measured by nanoindentation. Hardness and elastic modulus of the glasses were compared across substrate temperatures. After indentation, the topography of these films were studied using Atomic Force Microscopy (AFM) in order to further compare the relationship between thermodynamic and kinetic stability and mechanical failure.

[1]Z.F. and P.W. acknowledge funding from NSF(DMREF-1628407).

Sarah Wolf
University of Pennsylvania

Date submitted: 10 Nov 2016

Electronic form version 1.4