Measurement of Mechanical Properties with Nanoindentation*

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Nanoindentation has become one of the primary tools for measuring the mechanical properties of thin films such as those used in the microelectronics and magnetic storage industries. With this technique, a small hardness impression is made in the film with a sharp diamond indenter as the loads and displacements of the indenter are continuously recorded. By carefully analyzing the indentation load-displacement data, properties such as the hardness (H) and Young's modulus (E) of the material can be obtained, even from hardness impressions only a few nanometers deep. However, in order to obtain accurate measurements in thin films, influences of the substrate on elastic and plastic deformation in the film must be properly taken into account. In this presentation, recent experimental work and finite element simulations are presented which show how these influences are manifested, and how failure to account for them can lead to large errors in the measurement of hardness and elastic modulus.

* Research at the Oak Ridge National Laboratory ShaRE User Facility was sponsored by the Division of Materials Sciences, U.S. Department of Energy, under contract DE-AC05-96OR22464 with Lockheed Martin Energy Research Corp.