Abstract Submitted
for the MAR05 Meeting of
The American Physical Society

Incipient Plasticity During Indentation of a Well Characterized 3 Nanometer Radius Tip GRAHAM CROSS, SFI Trinity Nanoscience, ANDRE SCHIRMEISEN, Universitt Mnster , PETER GRUETTER, McGill Univerity, URS DUERIG, IBM Research Zurich — We present the results of nanoindentation testing of a well characterized tip geometry with a spatial scale easily matched by existing atomistic simulation. The atomically defined tungsten asperity of 3 nm radius was fabricated and imaged by field ion microscopy and brought into contact with a Au(111) terrace in ultra-high vacuum conditions. The mechanical evolution of the asperity contact under cyclic indentation testing was monitored by a simultaneous load-displacement and electrical current-displacement measurement. Load displacement curves of the pristine surface showed multiple discrete plastic ("pop-in") events during loading, with energies consistent with the nucleation of individual defects. During unloading, we observe reverse plasticity and complete self-healing of the induced defect. Both the qualitatative behaviour and measured energy dissipation values are in agreement with recent molecular dynamics simulations of incipient plasticity in metallic asperity contacts.

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Date submitted: 01 Dec 2004 Electronic form version 1.4