Fall 10-4-2015

A comparison of nanotribology and nanoindentation

Steffen Brinckmann
Max-Planck-Institut für Eisenforschung GmbH, s.brinckmann@mpie.de

Caroline Fink
Max-Planck-Institut für Eisenforschung GmbH

Gerhard Dehm
Max-Planck-Institut für Eisenforschung GmbH

Recommended Citation

S. Brinckmann, C.A.C. Fink, G. Dehm, Nanotribology in austenite: Normal force dependence, Wear, http://dx.doi.org/10.1016/j.wear.2015.04.023. S. Brinckmann, G. Dehm, Nanotribology in austenite: plastic plowing and crack formation, Wear, http://dx.doi.org/10.1016/j.wear.2015.05.001.

A COMPARISON OF NANOTRIBOLOGY AND NANOINDENTATION

Steffen Brinckmann, Max-Planck-Institut für Eisenforschung GmbH
s.brinckmann@mpie.de
Caroline C. A. Fink, Max-Planck-Institut für Eisenforschung GmbH
Gerhard Dehm, Max-Planck-Institut für Eisenforschung GmbH

Key Words: Wear, Friction, Hertz equation

Metal friction and wear is the collective contact and interaction of asperities of micrometer dimension. We use a nanoindenter with tangential force measurement to simulate the behavior in engineering contacts and to fundamentally understand friction and wear.
This presentation investigates the deformation due to a single stroke scratch of a diamond nanoindenter in austenite base. We find that the elastic and plastic equations for static indentation also apply for the dynamic scratching. Additionally, the friction coefficient is found to be normal force dependent and we observe three domains: microstructure dominated friction, plastic plowing dominated wear and wear particle dominated tribology.
Focussing on plasticity, we observe that the local crystal orientation has a significant influence on the development and spread of of plasticity. Additionally, the complex three-dimensional stress state results in the formation of non-obvious plastic slip patterns. Finally, we show crack formation in the scratch track even after a single stroke.

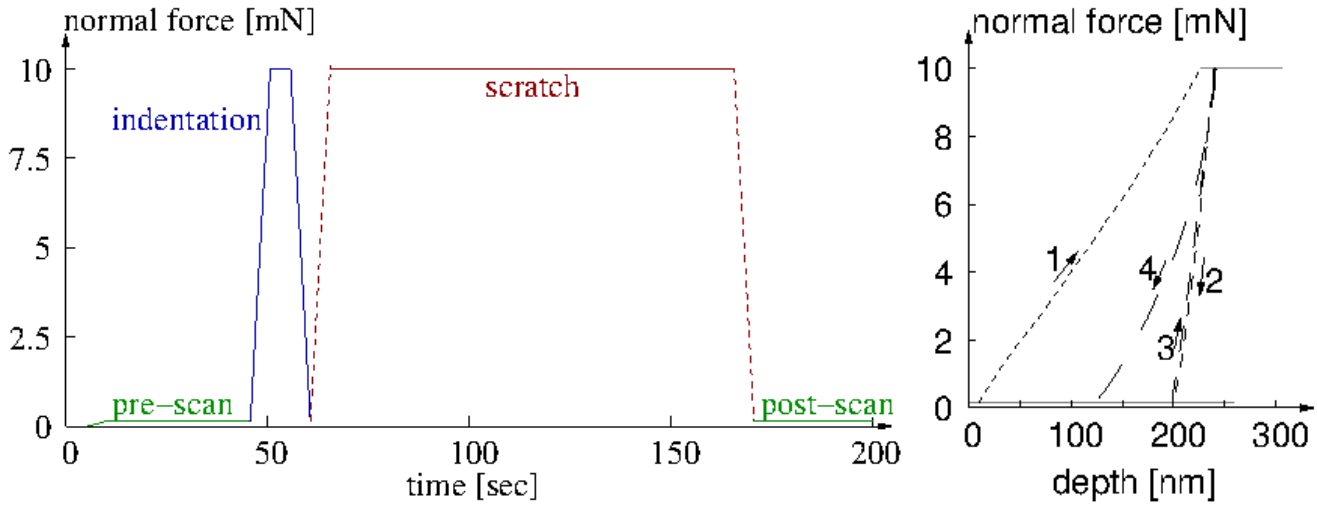

Figure 1 – Indentation, Unloading, Reloading, Scratching and final Unloading using a 5 µm nanoindenter tip. a) applied normal force vs. time curve. b) normal force vs. depth curve.

S. Brinckmann, C.A.C. Fink, G. Dehm, Nanotribology in austenite: Normal force dependence, *Wear*, http://dx.doi.org/10.1016/j.wear.2015.04.023.
S. Brinckmann, G. Dehm, Nanotribology in austenite: plastic plowing and crack formation, *Wear*, http://dx.doi.org/10.1016/j.wear.2015.05.001.