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A COMPARISON OF NANOTRIBOLOGY AND NANOINDENTATION

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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 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.

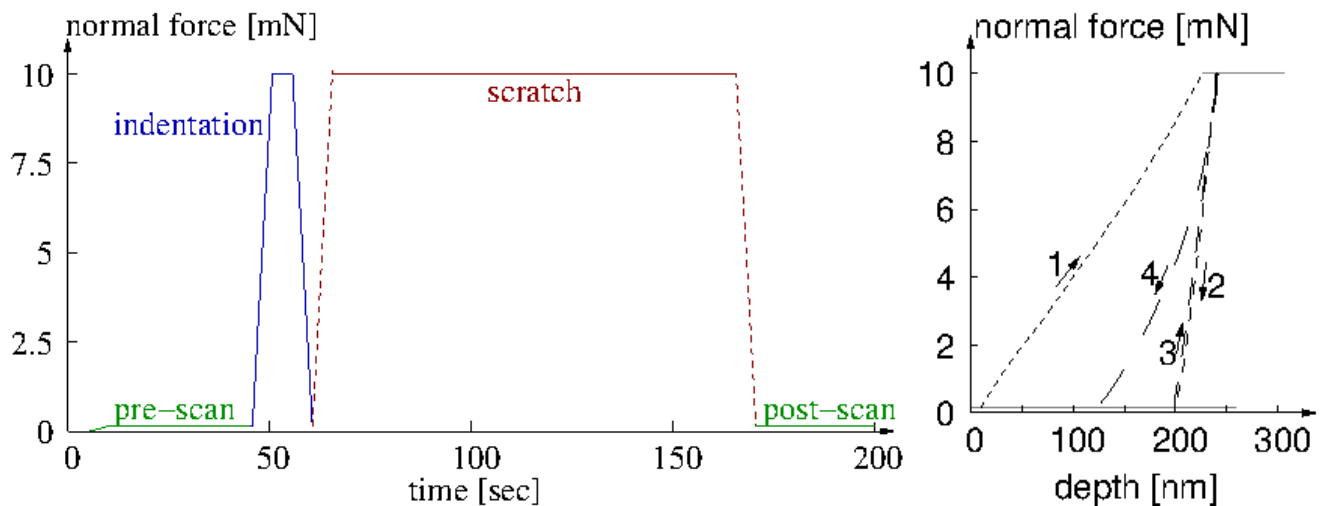


Figure 1 – Indentation, Unloading, Reloading, Scratching and final Unloading using a 5 μm nanoindenter tip. a) applied normal force vs. time curve. b) normal force vs. depth curve.

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