HIGH RESOLUTION STRAIN-MAPPING DURING IN-SITU NANOINDENTATION OF CVD THIN FILMS

Gudrun Lotze, MAX IV Laboratory, Lund University, Lund, Sweden
gudrun.lotze@maxiv.lu.se
Olof Bäcke, Department of Physics, Chalmers University of Technology, Gothenburg, Sweden
Sebastian Kalbfleisch, MAX IV Laboratory, Lund University, Lund, Sweden
Stefan Carlson, MAX IV Laboratory, Lund University, Lund, Sweden
Magnus Hörnqvist Colliander, Department of Physics, Chalmers University of Technology, Gothenburg, Sweden

Key Words: In-situ nanoindentation, scanning X-ray diffraction, time-resolved high-resolution strain-mapping

The NanoMAX beamline is a hard X-ray nanoprobe beamline at MAX IV Laboratory, Lund, Sweden. This beamline was designed to take full advantage of the exceptionally low emittance and the resulting coherence properties of the X-ray beam. A nano-focus beam of 50×50 nm^2 of high X-ray photon intensity is available for experiments. This small focus is ideal to investigate heterogeneous samples in materials science with high spatial resolution, utilizing techniques such as scanning X-ray diffraction, 2D X-ray fluorescence mapping, and coherent imaging in the Bragg geometry.

Chalmers University of Technology and MAX IV Laboratory have acquired a nanoindenter to be installed at the NanoMAX beamline. The combination of *in-situ* micro-mechanical testing and nano-focused scanning X-ray diffraction permits time-resolved high-resolution *in-situ* strain mapping. The experimental configuration is based on an Alemnis nanoindenter which is transferrable between the beamline and a scanning electron microscope (SEM). This allows for a sample characterization in a SEM prior to the X-ray beamline experiment. A potential science case is the investigation of local residual stress fields and their changes under increasing load.

Understanding the deformation mechanisms for thin hard coatings is vital for optimizing their use as wear resistant coatings. This new experimental configuration at NanoMAX will be applied to study the relationship between residual stress state, microstructure, and fracture in self-assembled nanolamellar CVD thin films.
We will present the first results of the commissioning of the nanoindenter installed at the NanoMAX beamline at MAX IV and explain potential applications.

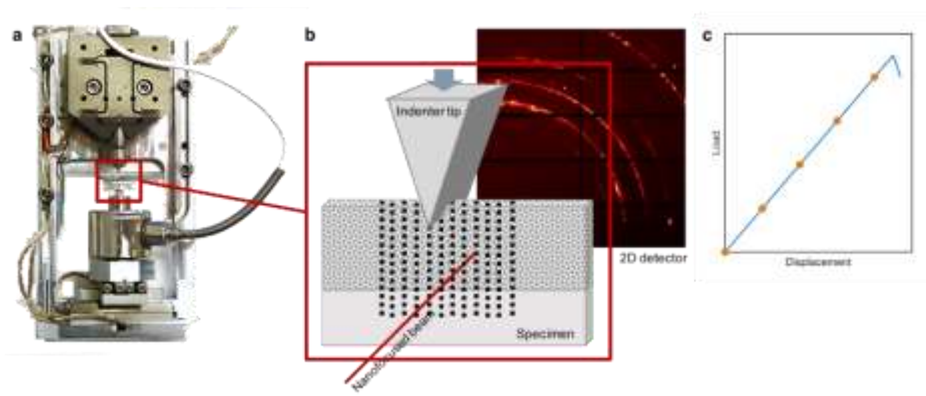

Figure 1. a: Picture of the nanoindenter. The actual size is approximately 65x160 mm. b: Schematic of the wedge indentation process and the mapping of the area below the indenter tip. c: Schematic illustration of a typical loading scheme, where the orange circles mark acquisition of maps for measurement of strain distributions.