Automatic Preparation of Straight Micropillars in FIB-SEM Instruments

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In this work the automatic preparation of micro-pillars by focused ion beam (FIB) milling in a bulk sample is described. Compression tests on such FIB fabricated pillars allow to characterize the mechanical deformation properties of the sample at the micron scale. Depending on the specific scientific question the preparation of a large number of pillars at different sample locations might be required. Therefore, an automatic fabrication approach becomes necessary.

Today, state-of-the-art Ga FIBs feature currents up to 100 nA allowing to fabricate a typical pillar – 5 \( \mu \)m in diameter, 15 \( \mu \)m tall, for which a surrounding area of 40 \( \mu \)m across has been freed up – easily within half an hour. In a second preparation step the geometry of the pillar can be further improved to achieve perfectly perpendicular pillar side walls using a technique commonly known as lathe milling \cite{1}. The ideal cylindrical geometry facilitates an accurate determination of material parameters from the stress-strain experiments. Using the application programming interface (API) of the FIB-SEM instrument the second lathe milling step was also automatized. Including lathe milling the total preparation time adds up to about an hour per typical pillar.

Limitations, possible improvements and alternative approaches to the described sample preparation method will be discussed in this workshop contribution.

References: