ESRF	**Experiment title:** Microstructural Changes in Thermo-Mechanically Strained Copper Thin Films and Interconnects	**Experiment number**: MA-1429
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The behavior of twin boundaries during in situ µLaue testing

Summary:
The aim of this experiment was to analyse the behaviour of twin boundaries during the plastic deformation of micron sized samples. The experiments were successful in the proposed form and only minor changes with respect to the proposal had been made, namely, we did not only test twin boundaries but also some general grain boundaries in order to get a broader view on the deformation behaviour at the micron scale.

In total, 18 samples (single crystalline, twin and general grain-boundary samples) had successfully been tested. The data evaluation for the general grain boundary is still ongoing. We expect the publication of the results in a high ranked material science journal such as Acta Materialia within the next year.

Report:
Tensile and compression samples had been prepared using our focused ion beam (FIB) workstation at our home facility. The samples were either single crystalline (grain orientation A or B) or bicrystalline with two grains (A,B) separated by a twin or grain boundary (see Fig. 1 as an example). The load vs. displacement curves were as expected for such kind of experiments.

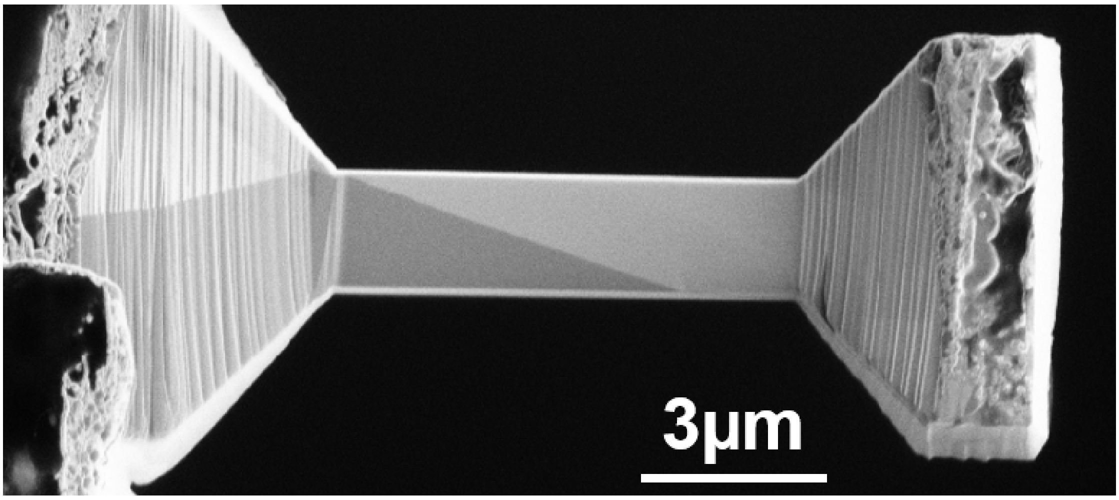

Fig. 1) SEM image of a 3x3x15µm³ sized tensile sample deformed at BM32/ESRF.

In case of general grain boundaries the complicated peak shape (see Fig. 2), the analysis of x-ray Laue patterns is tedious and is still ongoing. In particular the activation of several different slip systems with possible contributions to the lattice curvature, and the formation of numerous cells hinders an easy analysis of the diffraction pattern. To overcome this issue we currently launched a PhD thesis which should combine three dimensional electron backscatter diffraction (3D-EBSD) with Laue peak streaking analysis. 3D-EBSD thereby serves as a tool with very high angular resolution indicating regions with homogenous GND structures. Due to the volume fraction of this regions and their corresponding size with respect to the incoming beam we get important input for analysis of the Laue patterns and hope that the quantitative analysis works.

Even though the experiments worked as expected, a lot of efforts have to be put into measuring the plastic behaviour of grain and twin boundaries at the micron scale. For instance, other grain-boundary types as well as a modification of the cross slip probability is required to get a thorough understanding of dislocation grain-boundary interaction-

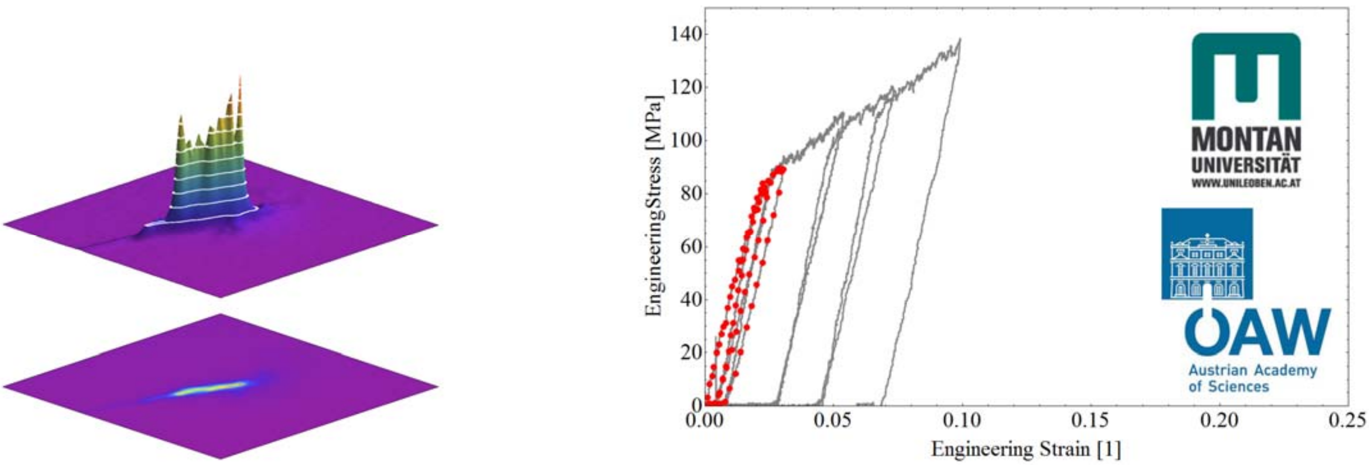

Fig. 2) (111) Laue image and stress strain curve of a bi-crystal with a general grain boundary. The red spots on the stress strain curve indicate when Laue images were recorded. After a relatively small amount of 5% engineering strain, the Laue peak is too complicated to be analysed by classical peak streaking analysis.