Insights into Deformation Mechanisms from *in-situ* Diffraction Experiments

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The usage of neutron and synchrotron x-ray diffraction as a tool to measure internal stresses has increased significantly in recent years. While a great deal can be learnt about the influence of processing and fabrication routes on materials by studying samples after processing, it is often beneficial to carry out controlled loading experiments. Loading samples *in situ* in the diffracting beam provides a direct insight into the micromechanical deformation mechanisms contributing to the macroscopic response of the sample as a whole, under user imposed environmental conditions. Combined with micromechanical modelling a great deal can be learnt regarding the way that the various mechanisms operate and interact, for example different slip modes and/or phase transformations. While both neutrons and synchrotron x-rays probe bulk rather than surface properties, the two techniques provide different opportunities and different challenges for such experiments. The techniques and capabilities will be explored via examples of studies of the deformation of metal and ceramic polycrystals.

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