INTERDISCIPLINARY CENTRE FOR
ADVANCED MATERIALS SIMULATION

ICAMS Seminar

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In-situ observation of microstructure-dependent local strain evolution

Monitoring the evolution of localized strain can shed light on various microstructure-related phenomena. In this context, digital image correlation (DIC) has emerged as a powerful tool as it can be employed to track the evolution of strain fields during in-situ tests with high lateral resolution. Similarly, electron-back scatter diffraction (EBSD) has become a standard technique in materials science as it provides for local data that can help to better understand the microstructure-mechanical property-relationship.

In the present study, both DIC and EBSD were used simultaneously to obtain data from the same area on microstructural evolution and the corresponding strain fields during in-situ tests. Widely different cases will be addressed to demonstrate the potential and the limitations of this experimental approach. Specifically, results from phase transformation both in steels and in shape memory alloys will presented that highlight the importance of variant selection during phase transformation. It will be demonstrated that it is this combined data that helped to understand the microstructural mechanisms that drive microstructure-controlled phenomena such as transformation plasticity.

It will also be shown that both techniques can be applied to study damage evolution during fatigue. The data obtained show that local variations in microstructure such as the distribution of low and high angle grain boundaries can give rise to enhanced localized plasticity and early fatigue failure.

The combination of DIC with a lateral resolution that equals the relevant microstructural features with EBSD can also provide data that can be used to validate microstructure-based models, and some preliminary studies that address this aspect will be presented.