Ductile damage study for complex loading paths and low stress triaxiality via 3D synchrotron imaging and FE simulations

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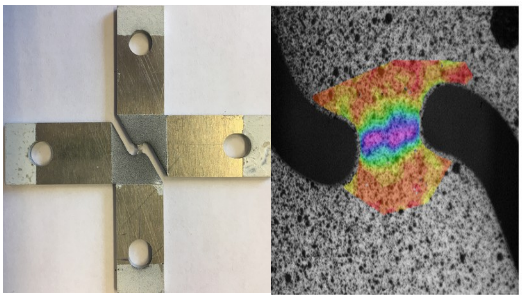

- Ductile Damage
- Tomo(Lamino) graphy
- Aluminium
- Strain
- Digital Volume Correlation
- Load path change
- Simulation

Abstract:

In the pursuit of lighter materials and optimized thin-walled components for transportation, knowledge about the characteristic ductile damage mechanisms in metal sheets is key. As the study of damage in materials has, up to now, been focused on proportional loading, the strain-damage interaction is not understood for the highly application-relevant bi-axial loading with load path changes.

Thus, our proposal aims at three-dimensional (3D) imaging of the microstructure inside flat sheet specimens evolving during material testing under such loads. For this, we extend the capability of *in situ* synchrotron laminography to overcome inherent shortcomings of other 3D techniques for such kind of samples. It shall be developed into a unique multiscale imaging approach from a few hundred micrometres resolution down to the nanometre scale to determine the ductile damage nucleation and growth kinetics. Strain in the material bulk will be measured using digital volume correlation. Such hierarchical 3D data will then serve as valuable input for microscopic simulations and the formulation and validation of continuum damage models suited to predict engineering-relevant mechanical properties.