TOWARDS AN INTEGRATED EXPERIMENTAL/MODELLING FRAMEWORK TO ACCOUNT FOR MICROSTRUCTURAL EFFECTS ON DAMAGE UNDER EXTREME CONDITIONS

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Focus Material: Metals

Focus of the Presentation: *(i) Physics-based multi-scale model development*

Abstract

In-situ non-destructive 3-D characterization and micromechanical formulations that can use direct input and be validated by those emerging methods are enabling the discovery and modelling of microstructural effects on mechanical behavior of polycrystalline materials.

In this talk we report the synergistic combination of Fast Fourier Transform-based methods (e.g. [1]), which can efficiently use the voxelized microstructural images of heterogeneous materials as input to predict their micromechanical response, and High Energy Diffraction Microscopy (HEDM) (e.g. [2]) and tomography obtained in metallic aggregates developing porosity during plastic deformation that allowed us to study how microstructure affects ductile damage in these materials.

While the present experimental/modelling framework is adequate to study processes occurring at relatively low strain-rates, efforts towards extending it to dynamics extremes will be described.

References

[1] Lebensohn R.A., Escobedo J.P., Cerreta E.K., Dennis-Koller D., Bronkhorst C.A. and Bingert J, 2013, "Modelling void growth in polycrystalline materials". Acta Mater. **61**, pp. 6918-6932.

[2] Pokharel R., Lind J., Li S.F., Kenesei P., Lebensohn R.A., Suter R.M. and A.D. Rollett, 2015, “In-situ observation of bulk 3-D microstructure evolution of polycrystalline Cu using synchrotron radiation”. Int. J. Plasticity **67**, pp. 217-234.