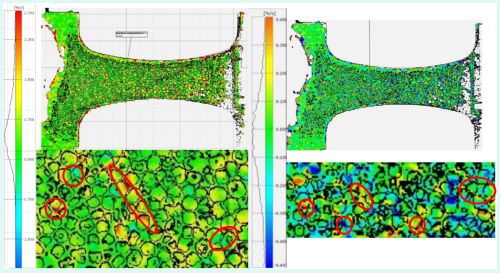
DIC analysis of deformation in Harmonic Structured materials

MASTER THESIS PROJECT(30HP)

1. Background



Modern demands in structural materials can be hardly met by the traditional polycrystalline materials with *homogeneous* structures. Such materials are either ductile but too soft when coarse-grained (CG; crystallite size d≥10μm) or strong but too brittle when nano- or ultrafine-grained (UFG; crystallite size d≤1μm).

Since strength and ductility are both important characteristics for the majority of structural applications, materials with their superior combination are *hot* as ever. Division of Materials Engineering at LTH works extensively on the development of materials with multi-scale architectured *heterogeneous* harmonic structures (HS).

2. Challenge

HS features islands of soft and ductile CGs embedded into a continuous 3D skeleton of their strong UFG counterparts. They demonstrate versatile structural performance, but the mechanics of their deformation mechanisms is not well understood. We have been fabricating HS materials using powder metallurgy approach at Ritsumeikan University in Japan and investigating their performance along with developing Finite Element models for the optimisation of design in Lund. In this project, we need to analyse correlation between global and local strain distribution during tensile testing of such materials using digital image correlation (DIC). In particular, you will:

- Develop a method for metallographic surface preparation on miniaturised tensile specimens for achieving optical contrast sufficient for DIC analysis;
- Carry out tensile testing with simultaneous *in situ* acquisition of video signal for DIC analysis; if necessary, these will be complemented with nano-hardness tests;
- Analyse and report correlation between the grain- / particle- resolved strain and the global deformation of the entire specimen.

All the work including DIC analysis, sample preparation, etc will be carried out in the Division of Materials Engineering at LTH, LU in Lund.

3. Reporting

The work is suitable for 1-2 students from the M, F, K, N programs. The project shall be concluded with a written MSc thesis and oral presentation shall be given at LTH, LU.

4. Contacts

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