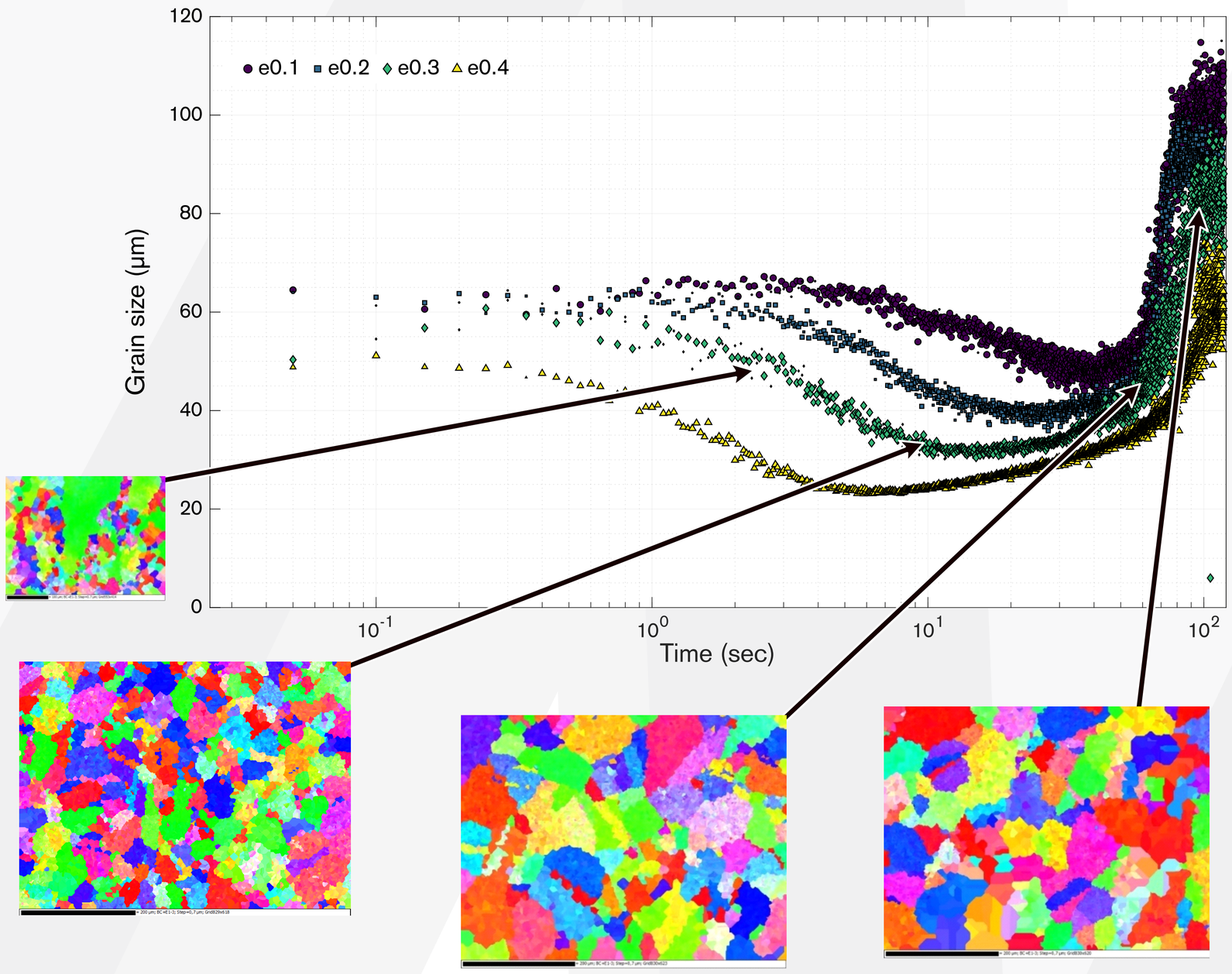
GLUS®– GLEEBLE & LUS

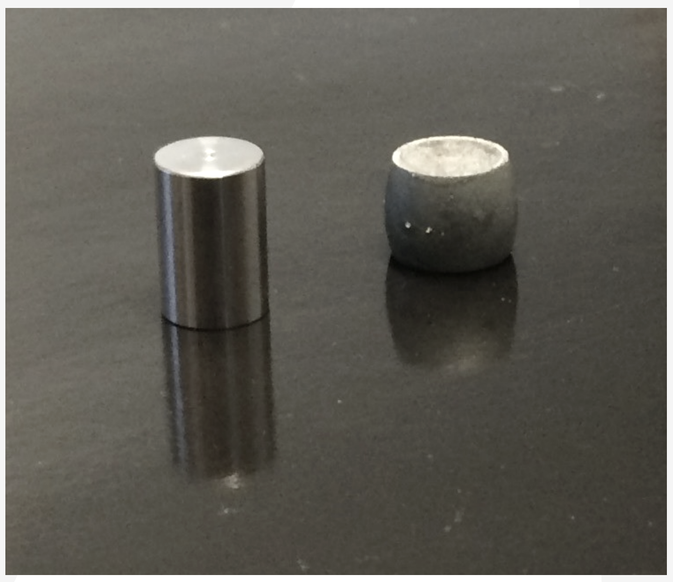
Swerim has developed a technique which makes it possible to investigate microstructural conditions such as grain size, texture and phase transformations in-situ during heating and/or deformation. GLUS® is a combination of in-situ measurements with LUS (laser ultrasonics) during testing in a thermo-mechanical annealing simulator (GLEEBLE).



The graph show the grain size measured with GLUS® as a function of time after 10-40 % compression.

Stress relaxation is visible due to recovery only for times up to 0.5 s, where the grain size is virtually constant. Subsequent stress relaxation is accompanied by decrease in grain size so can be interpreted as being associated with recrystallization.

Knowing the whole grain size evolution is important for determining material parameters which is crucial for proper modelling of the material. The times corresponding to this recrystallization are shorter the higher is the applied strain, as expected due to the greater driving force. Also, the minimum values of grain size decrease in the same order. This is the usual behavior where higher deformation levels give rise to finer as-recrystallized grain structures. With longer holding times there is no further load relaxation but the grains grow back to a size similar to that before the deformation.



Typical sample before and after GLUS®-analysis.

How does it work?

LUS is a non-contact method and is thus the technique capable of operating in steelwork environment/on hot samples. The thermo-mechanical annealing simulator (GLEEBLE 3800) gives the possibility for very rapid heating/quenching and/or deformation (tension/compression) of the sample.

With GLUS® it is possible to perform in-situ characterization of the microstructure, for example grain size/growth, texture, austenite condition, transformation characteristic) during simulated hot-rolling. Mechanical properties such as E-modulus and Poisson's Ratio can also be investigated at different temperatures.

Industrial benefits

The GLUS® is very suitable for in-situ analysis of microstructure and mechanical properties in metals during thermo-mechanical testing. GLUS® gives a opportunity for reduction of cost during material development and is also a good tool for a larger understanding of the production process – what state is the metal in at position "X" in the process?

Contact
Mikael Malmström, mikael.malmstrom@swerim.se
David Martin, david.martin@swerim.se

www.swerim.se