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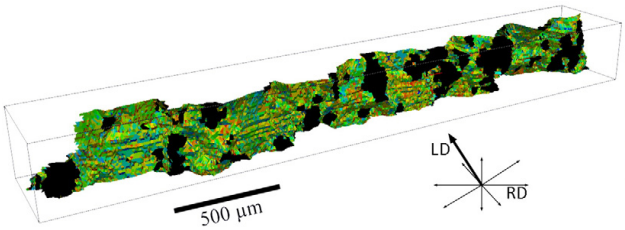
Research interests:
Metal Physics, Crystallographic Texture, Crystal Plasticity, Microstructure, Electron Microscopy

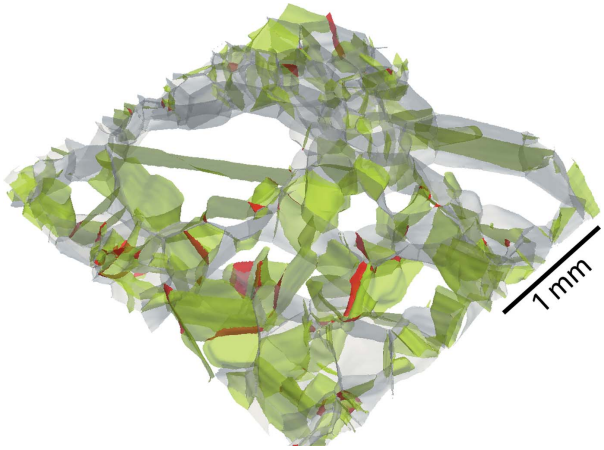
PI

Crystallographic Aspects of Microstructures

Recent Research activities:
The research group focuses on optimising mechanical properties of metal alloys, by improved microstructural control. New and advanced microstructural characterisation techniques are applied to picture the microstructure. Recent progress has been obtained Especially with regard to 3D imagining in wide field observations, covering various cube millimetres of range).



3D view of a fatigue crack surface in grey cast iron. Graphite particles are depicted in black. [1].



3D Network of grain boundaries in a coarse grained Ni-sample [2]

The results of 3D characterisation are employed e.g. to study the microstructural effects on fatigue properties of grey cast iron with vermicular graphite morphology. It was determined that the graphite particles played a dominant role both in crack initiation and crack propagation. Precise characterisation of the 3D structure is also of crucial importance to determine the properties of grain boundaries such as e.g. the crystallographic anisotropy of the grain boundary energy.
Considerable effort was spent in developing a theoretical a framework to design virtual 3D microstructures. This work is of importance for developing new microstructural evolution models, which allow gauging the effect of various solid-state transformation process on the microstructure.

Key publications:
[1] H. Pirgazi, S. Ghodrat and L. A.I. Kestens, Mat Char (2014) 90, 13-20.
[2] H. Pirgazi, K. Glowinski, A. Morawiec and L. A.I. Kestens, J. Applied Crystallography (2015) 48, 1672-1678.
[3] L. Lapeire, J. Sidor, P. Verleysen, K. Verbeken, I. De Graeve, H. Terryn, L.A.I. Kestens, Acta Mat (2015) 95, 224-235.
[4] J. Sidor, K. Decroos, R. H. Petrov and L A.I. Kestens, Int. J. Plasticity (2015) 66, 119-137.

Theme

Microstructure and Mechanical Behaviour

Metals for structural applications are used because of their mechanical properties such as strength, formability or fatigue resistance. With increasing environmental demands there is a permanent need for metal alloys with improved mechanical properties. Most mechanical properties are sensitive to the microstructural features of the alloy, representing the structural characteristics on nano or micron scale. The essential challenge in this research is to obtain a physics based understand of the intricate relation between the microstructural architecture of the material and its mechanical properties.

In this research extensive use is made of microstructural characterization techniques such as optical and electron microscopy (both SEM and TEM). It is the aim of the research group to analyse microscope images so as to obtain a statistically accurate description of the microstructural state variables. This is an essential prerequisite to obtain a fundamental description of the mechanical behavior resolved in terms of the microstructural features of the material.