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MODELLING OF DAMAGE IN HETEROGENEOUS MICROSTRUCTURES

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ABSTRACT

The performance of machines and devices depend on the properties of the materials used. Since these materials nowadays have a complex constitution and individually shaped characteristics, the damage and failure of structural parts and components can only be understood if the deterioration of the underlying microstructure is properly included in the modelling. Using appropriate numerical models for these heterogeneous materials is therefore an indispensible but nevertheless challenging task. In addition, microstructural characterisation in computational mechanics is only the first step to optimisation of materials.

This symposium aims at the local discretisation of damage and cracking in microstructures of various classes of materials that are heterogeneous in some respect. These materials contain: multi-crystal and multiphase metals, any kind of composites and reinforced materials with percolating, clustered, oriented or randomly distributed ingredients, layered microstructures and laminates, bi- and multimaterial systems as they appear in joint regions of structural bonds and thin films, and also porous materials and foams. Of course, also other heterogeneous materials and material combinations not mentioned here are also welcome.

The focus lies on the modelling of nucleation and evolution of damage and microcracks in the materials mentioned above. Works on mathematical theories, modelling issues and simulation of (real or artificial) microstructures can be submitted. The techniques used may start from atomistic modelling, phase field methods, and of course any kind of finite element/boundary/difference methods and similar techniques.

Especially encouraged are works that include scale bridging, in particular if they use different modelling techniques for different scales. Besides that, the identification of damage parameters for macroscopic models from the microstructure, comparison with experimental data and validation of the models by experimental characterisation are highly appreciated. The optimisation of microstructures is the main goal for the improvement of structural performance and therefore deserves special attention.

The absolute scale modelled can be of any size as long as the investigated material volume can be homogenised to a material point in the structural continuum scale, that is, in geologic plate tectonics, the scale might also be in the order of metres. The lower bound for the size is of course the atomic scale.