Phase-Field Modelling of Thermoelastic Cracking in Polycrystalline Materials - CFRAC 2019

Daniel Juhre* **and Zhengkun Liu**†

* Department of Computational Mechanics
Institute of Mechanics
Otto von Guericke University Magdeburg
39106 Magdeburg, Germany
e-mail: daniel.juhre@ovgu.de - Web page: http://www.ifme.ovgu.de/

† Department of Computational Mechanics
Institute of Mechanics
Otto von Guericke University Magdeburg
39106 Magdeburg, Germany
e-mail: zhengkun.liu@ovgu.de - Web page: http://www.ifme.ovgu.de/

ABSTRACT

Recently, the phase-field method has been widely used to simulate crack initiation, curved crack propagation, crack branching and merging of cracks without serious difficulties (Ambati et al. 2015). However, macroscopic defects are generally strongly influenced by the fracture behavior of polycrystalline materials at meso- and microscopic level. Therefore, the effect of thermomechanical loading has been studied in polycrystals with anisotopic material properties by the newly developed micromechanical phase-field model. At meso- and microscopic level, each grain has different material properties, e.g. elastic anisotropic behavior. Numerical simulations are presented and thermal stress induced crack initiation and propagation have been highlighted. It is clear from the numerical results that anisotropic properties and the crystallographic orientation can obviously affect the final crack patterns results under thermomechanical loadings. Moreover, the effect of grain size has been studied. The results show that microscopic behavior of polycrystalline materials could affect the thermoelastic damage evolution of macroscopic components. It is demonstrated that the proposed phase-field model is capable of characterizing fracture propagation in anisotropic solids under thermomechanical loading.

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