

# Modeling inter/ trans granular failure using an anisotropic phase field approach

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A new multi-phase-field method is developed for modeling the fracture of polycrystals at the microstructural level. Inter and transgranular cracking, as well as anisotropic effects of both elasticity and preferential cleavage directions within each randomly oriented crystal are taken into account. For this purpose, the proposed phase field formulation includes: (a) a smeared description of grain boundaries as cohesive zones [1], avoiding defining an additional phase for grains; (b) an anisotropic phase field model [2]; (c) a multi-phase field formulation where each preferential cleavage direction is associated with a damage (phase field) variable. The obtained framework allows modeling interactions and competition between grains and grain boundary cracks, as well as their effects on the effective response of the material. The proposed model is illustrated through several numerical examples involving a full description of complex crack initiation and propagation within 2D and 3D models of polycrystals.

## References

- [1] T.T. Nguyen, J. Yvonnet, Q.Z. Zhu, M. Bornert, C. Chateau, A phase-field method for computational modeling of interfacial damage interacting with crack propagation in realistic microstructures obtained by microtomography, *Computer Methods in Applied Mechanics and Engineering*. 312 (2016) 567–595.
- [2] T.T. Nguyen, J. Réthoré, Phase field modelling of anisotropic crack propagation, (submitted).