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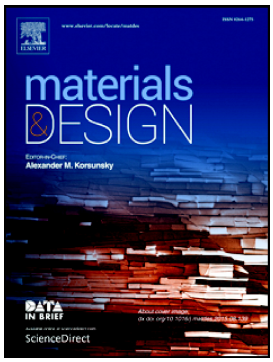

A novel Level-Set Finite Element formulation for grain growth with heterogeneous grain boundary energies.

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A novel Level-Set Finite Element formulation for grain growth with heterogeneous grain boundary energies.

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Abstract

Grain growth is a ubiquitous thermally activated mechanism by which the microstructures of crystalline materials coarsen at relatively high temperatures. Individual grain boundaries in a material microstructure have their own structure and their own behavior and, as such, uniform grain boundary energy modelling approaches arrive at their predictive limits when it comes to certain types of local phenomena (abnormal grain growth, thermal twinning, etc). This work presents a new heterogeneous grain boundary energy formulation for grain growth built on the thermodynamics of the phenomenon that can handle high grain boundary energy gradients. Using a full field finite element numerical framework it verifies the precision and convergence of this new formulation.

Keywords: grain growth, grain boundary energy, finite element, level-set, triple junction, modelling

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