

Development of multi-phase-field crack model to express crack propagation in polycrystal

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Fracture of brittle material is caused by crack propagation in complicated microstructure. Therefore, the high precision evaluation of crack propagation in the microstructure is extremely important for safe and life evaluations. Although finite element method has been widely used in simulations to evaluate the crack propagation, it is difficult to use it in microstructure. Phase-field method has emerged as a powerful tool to simulate the microstructure evolutions and has been applied to the crack propagation problem. Because the phase-field crack model doesn't require tracking of the crack tip position and remeshing process, it is thought to be easy to apply it to the crack propagation prediction in complex microstructure. In this study, we develop multi-phase-field crack model that can represent crack propagation and polycrystalline microstructure evolution simultaneously. In addition, we simulate the crack propagation in the polycrystal using the developed model.

Keywords: multi-phase-field method, crack propagation, polycrystal, fracture mechanics