A 3D MONTE-CARLO (POTTS) MODEL FOR RECRYSTALLIZATION AND GRAIN GROWTH IN POLYCRYSTALLINE MATERIALS

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S u m m a r y

The recrystallization of polycrystalline metallic materials is modeled by using a 3D Monte-Carlo (Potts) approach, in which the initial microstructure, texture [orientation-distribution function (ODF)], spatial distribution of the stored energy of deformation, and nucleation mechanism are carefully quantified. The formation of a microstructural and textural inhomogeneity due to the recrystallization in deformed single-phase metallic materials is thus predicted. The modeling technique is tested using several special cases of common deformation textures for commercial beta-titanium alloys. It is demonstrated that the differences in an initial material texture affect the recrystallization kinetics even when nucleation mechanisms and grain-boundary properties are assumed to be the same. By taking the properties of special boundaries into account, the classical JMAK (Johnson-Mehl, Avrami, and Kolmogorov) kinetics is reproduced better during the simulation, and the grain-size distributions within the recrystallized material are broadened.