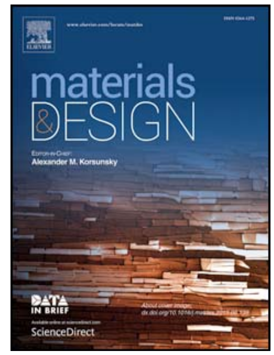

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A new topological approach for the mean field modeling of dynamic recrystallization

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Abstract

This paper proposes a new approach for mean field modeling of dynamic recrystallization. The main advantage of the presented model compared to the state of the art is based on a more precise description of the immediate vicinity and of the shape of each grain to describe microstructural evolution all along the hot deformation process. Results provided by the new model are compared to those of a former mean field formulation and those of a full field model with an explicit description of the microstructure. The predictions of the new model in terms of recrystallization kinetics and grain size distributions are satisfactory and the progress when compared to former mean field models is obvious. Furthermore, the limitation of mean field models concerning the non-realistic shape of grain size distributions has been solved in this new formulation.

Keywords: microstructure, mean field modeling, topology, recrystallization.

1. Introduction

During hot deformation of metal alloys, the mechanisms of strain hardening and recovery tend to increase and reduce the energy stored in the material respectively. When the stored energy level is high enough locally, new grains nucleate. In parallel, grain boundaries migrate as a result of stored energy gradients across interfaces and capillary effects. The combination of those mechanisms leads to so-called dynamic

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