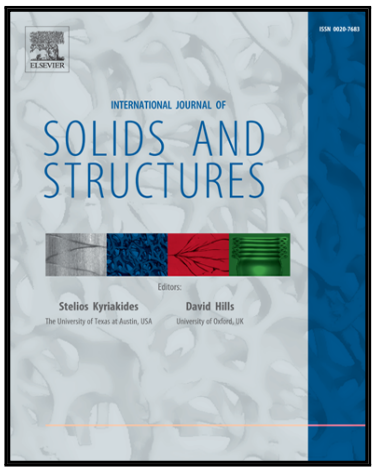

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Multiphase-field modeling of martensitic phase transformation in a dual-phase microstructure

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Abstract

Ferritic-martensitic dual-phase steels (DP) offer beneficial material properties for industrial applications. Understanding the microstructural evolution within the production chain and its consequences for the mechanical characteristics allows to improve the material properties by changing specific process parameters. In addition to experiments, numerical methods are a helpful tool to explore these correlations. For this purpose, we present an elastic multiphase-field model to study the martensitic phase transformation in a DP microstructure. An EBSD scan of an as-received commercial DP600 finished strip is used to generate a virtual, initial ferritic-austenitic microstructure. Based on the initial polycrystalline microstructure, the applied multiphase-field model is able to predict the evolution of the martensitic variants in austenitic grains, including grain boundary and autocatalytic nucleation. The approach identifies grain boundaries lying parallel or perpendicular to the habit plane of martensitic variants as preferred nucleation sites. We discuss the resulting stress distribution and show its correlations to retained austenite.

Keywords: Multiphase-field model, Dual-phase steel, Martensitic phase transformation, Microstructure evolution, Polycrystals

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