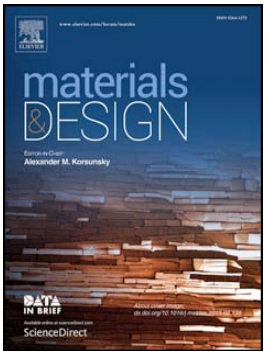

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Constructing Micro-mechanical Representative Volume Element of Medium Mn Steel from EBSD data

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Abstract

Medium Mn advanced high strength steel (AHSS) with significant combination of strength and ductility is one of candidates of the Third Generation AHSS. However, the specific plastic instability behavior of medium Mn steels is different from traditional steels and physical mechanism behind it is unclear. Representative volume element (RVE) has been proved to be applicable of describing microstructural deformation and revealing the micro-deformation mechanism. In this paper, a two dimensional micro-mechanical RVE of medium Mn steel, 7MnCA, is constructed from its electron back scatter diffraction (EBSD) data. The deformation behavior under uniaxial tension is investigated based on the constructed RVE models incorporating with phases morphology and distribution. The results show that the present RVEs constructed from EBSD data through image-processing algorithm with different filling strategies are capable to predict the macroscopic mechanical behavior of medium Mn steel with finite element analysis.

Key words: Medium Mn steel, Representative volume element, EBSD, Finite element analysis

1. Introduction

Significant researches have been focused on the Third Generation Advanced High Strength Steels (Gen.3rd AHSS) in the past decades to achieve greater fuel efficiency and reduce car-body weight while maintaining high safety standards and superior formability in automobile industry (Findley et al., 2017; Bhargava et al., 2015; Liu et al., 2015). As one of potential candidates, medium Mn steels have been actively investigated due to their excellent balance between material cost and mechanical properties (Kang et al., 2016; Chang et al., 2016; Lee and Cooman, 2013; Lee et al., 2015). However, the phenomenon of formation and propagation of plastic instability bands has been well observed in medium Mn steels deformation while physical mechanism behind

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