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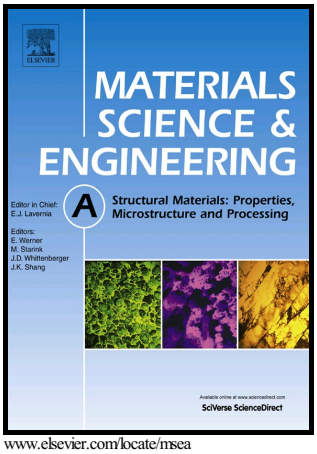

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Abstract

Due to the inhomogeneous deformation of the microstructure, it becomes difficult as well as necessary to determine the mechanical behavior of multi-phase high strength steels precisely. In this study, the strain distribution of microstructure is obtained utilizing Point Interpolation Method (PIM). The strain of microstructure with an exponential function of overall strain presents greater deformation in Ferrite than Martensite. Considering the characteristic deformation of individual phases, a dislocation based combined strain-hardening model is proposed to describe the overall stress-strain relationship of the material. The agreement between theoretical model and experiment results is verified by DP800. Based on the model, the stress-strain response of DP steels to different grain sizes and volume fractions of individual phases is studied. The strength and strain hardening behavior of DP steels with finer Ferrite, coarser Martensite and higher content of Martensite are significantly improved. In addition, dislocation mean free path, dislocation density, strain-hardening rate and hardening exponent of individual phases are calculated to describe the strain-hardening mechanism of individual phases and DP steels.

Keywords: Local deformation, Strain-hardening, Dual phase steels, Martensite, Ferrite

1. Introduction

Mechanism of microstructure evolution governing mechanical properties of multi-phase high strength steels has been an area of intense investigation since program Ultra-Light Steel Auto Body-Advanced Vehicle Concepts (ULSAB-AVC) makes highly use of Advanced High Strength Steels (AHSS) [1] in automobile manufacturing. Nearly 48% of all these AHSS in utilization are dual phase (DP) steels consisting of matrix phase and hard phase [2]. In order to investigate the mechanical properties (i.e. strength and ductility) of DP steel, plenty of researches have been conducted.

On the one hand, many researchers have investigated the inhomogeneity of DP steels during deformation. Based on the Swift Law, Tomota et al. 1992 [3] found the relationship between