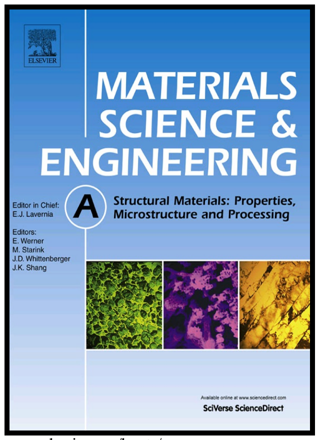

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Abstract

In the present work, the hot deformation behavior of four TWIP steels is studied by conducting compression tests at the strain rates in the range 0.01-5 /s and temperatures in the range 950-1100 °C using a Gleeble thermomechanical simulator. The four steels differed with respect to their chemical compositions. They were non-microalloyed, Nb-microalloyed, V-microalloyed and high-Al V-microalloyed. The microstructural evolutions are studied by a scanning electron microscope (SEM) equipped with electron backscattered diffraction (EBSD) detector. Also, the hot deformation behavior of the steels are modeled using the dislocation density based Bergstrom and the diffusional transformation based Kolmogorov-Johnson-Mehl-Avrami models. The peak stresses of the high-Al V-microalloyed variant occurred at higher strains than in the V-microalloyed variant. The microstructure of the Nb-microalloyed variant showed that dynamic recovery was more active than dynamic recrystallization (DRX) when the steel was deformed at lower temperatures, i.e. lower than 1000 °C. Bergstrom modeling showed that as the Zener–Hollomon parameter (Z) increases, the hardening parameter for the V-microalloyed steel increases at a clearly higher rate than the others. Finally, it was seen that increased strain rate leads to decreased Avrami exponents (n_A) for the Nb-microalloyed and the high-Al V-microalloyed variants suggesting the occurrence of dynamic recrystallization (DRX) with nucleation on grain and twin boundaries.

Keywords: TWIP steels, Physically Based Modeling, hot deformation, EBSD, recrystallization

Nomenclature

A	Material constant (/s)
A'	Material constant (Pa)