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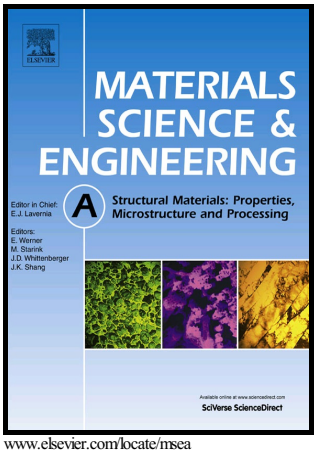

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ABSTRACT

The present study was attempted to evaluate the microstructural evolution and mechanical properties of a 3 wt.%Al containing medium Mn steel which was warm rolled with different thickness reductions directly after intercritical annealing at 750 ℃ by using scanning electron microscopy (SEM), transmission electron microscopy (TEM), X-ray diffraction and tensile tests. The results show that the laths of ferrite and retained austenite (RA) not only gradually rotated their longitudinal axis to the rolling direction but also were refined with increasing rolling thickness reduction, and thus a well developed lamellar structure of bimodal size distributed lathy ferrite and RA was obtained after heavy rolling reduction. Though the strength increases while the ductility decreases with increasing rolling thickness reduction, an excellent combination of strength and ductility expressed by the product of ultimate tensile strength (UTS) to total elongation (TEL) of ~50 GPa% was obtained through a wide process window of warm rolling. It is thus proposed that warm rolling is a promising way to simplify the traditional multi-stage rolling and annealing processes of Al-containing medium Mn steels, especially to overcome the cold rolling difficulty of medium Mn steels with high carbon content.

***Keywords*:** Al-containing medium Mn steel; Warm rolling; Intercritical annealing; Microstructures; Mechanical property; TRIP effect.

1. Introduction

Recently, medium Mn steel typically alloyed with ~3 wt.% to ~10 wt.% Mn has regained significant attention as one of the most promising candidates for the third-generation automobile steel due to its excellent combination of ultra-high strength and considerable large ductility as well as comparatively low materials cost and industrial feasibility [1-5]. This new type of steel usually exhibits a martensitic microstructure after hot rolling due to the high Mn content and correspondingly enhanced hardenability [6-8], and an ultrafine duplex microstructure with a large fraction of retained austenite (RA) (up to ~60 vol.%) after relatively simple intercritical annealing process, also known as austenite reverted

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