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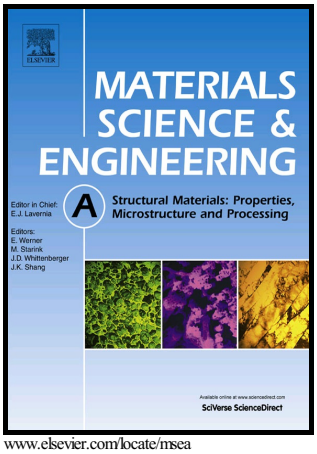

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Toward unraveling the mechanisms responsible for the formation of ultrafine grained microstructure during tempering of cold rolled martensite

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Abstract

The mechanisms responsible for the formation of ultrafine grained microstructure during tempering of cold-rolled martensite in a low-carbon steel at moderate temperatures were unraveled based on the microstructural examinations and mechanical properties. A type of continuous recrystallization process was found to be the main phenomenon that controls the microstructural evolution.

Keywords: Steels; Tempering; Continuous recrystallization; Precipitation; Coarsening.

1. Introduction

Among the strengthening mechanisms, grain refinement has an advantage that improves both strength and toughness [1]. Many techniques based on severe plastic deformation and advanced thermomechanical processing have been proposed so far for grain refinement of metallic materials [2]. Thermomechanical processing on a martensite starting microstructure is claimed to be an efficient grain refining approach in low carbon steels [3-7], which normally includes simple rolling that requires low reductions in thickness (~ 50%) followed by short tempering at moderate temperatures (e.g. 0.5 h at 500 °C) to produce ferrite grain size of ~ 180 nm [3].