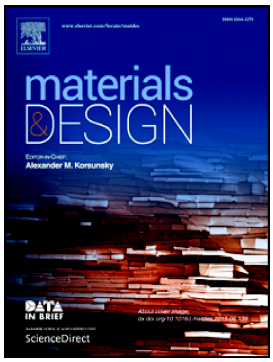

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Strain rate dependence of ferrite dynamic restoration mechanism in a duplex low-density steel

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Abstract

The ferrite major dynamic softening mechanisms, particularly in duplex microstructures, have long been a matter of debate among steel scientists. It has been shown in the present work that a marked increase in the strain rate at a high temperature leads to a transition in the ferrite softening mechanism in low density steels. In contrast to the current widespread view, ferrite was found to soften through continuous dynamic recrystallization at a low strain rate and via discontinuous dynamic recrystallization at a high strain rate. The latter mechanism is largely associated with the interphase mantle regions, rather than the scarce original ferrite-ferrite boundaries. In these regions, the new grains were observed to develop through the growth of highly-misoriented subgrains.

Keywords: *hot deformation; restoration; strain rate; low density steel*

1. Introduction

Considering the extensive use of steels in automobiles, any reduction in the density of steels while tailoring satisfying mechanical performance would make automotives lighter. This would then result in reduced emissions. Research on the first generation of low density steels goes back to 1930s [1]. The properties of the advanced Al-containing low density steels, however, have been only recently studied [2-4], and there are still many unresolved aspects which need to be clarified. Conventional low density steels are either austenitic or