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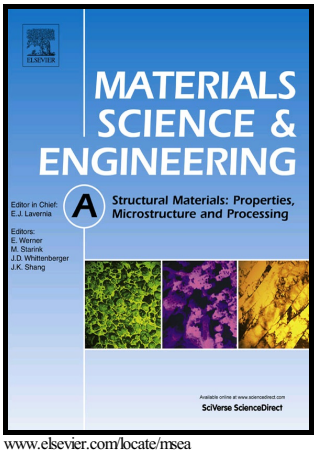

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Deformation induced austenite formation in as-cast 2101 duplex stainless steel and its effect on hot-ductility

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Abstract

The microstructural evolution during hot deformation of 2101 grade lean duplex stainless steel and its effect on hot-workability have been investigated by hot-compression testing using Gleeble® simulator over the range of deformation temperature of 800-1100°C. Besides the dynamic recovery of δ-ferrite matrix and deformation of large austenite (γ) regions, fine γ-islands (< 8 μm in size) were observed to form inside the δ-matrix. The density of those islands reached the highest value at deformation temperature of 900-1000°C and increased significantly with the increase in applied true strain from 0.25 to 0.8. Such γ-islands are expected to form either by dynamic strain induced δ to γ transformation or by γ to δ strain-induced transformation followed by rapid precipitation of γ on heterogeneous nucleation sites (sub-grain boundaries, deformation bands etc.) present in the δ-matrix. The average size of the islands decreased with the decrease in deformation temperature. As the precipitated γ-islands follow Kurdjumov-Sachs orientation relationship with the δ-ferrite matrix, formation of such islands is detrimental to the hot-workability of the duplex stainless steel. Those islands not only restrict the plastic flow in δ-matrix but also provide favourable path for crack propagation through the δ.

Keywords: Lean duplex stainless steel; Hot deformation; Austenite precipitation; Interphase boundaries; Orientation relationship; Crack propagation.

1. Introduction:

Duplex stainless steel (DSS) containing austenite and ferrite, has emerged as the low-cost alternative to austenitic stainless steel and it has been widely used in oil, gas, paper, desalination and petrochemical industries **[1]**. DSS shows an excellent combination of resistance to general and localized corrosion, stress corrosion cracking and high strength. It is