MICROSTRUCTURAL EVOLUTION IN FCC/B2-DUPLEX LOW-DENSITY STEEL DURING ANNEALING OF COLD ROLLED SHEET AND RESULTANT CHANGE IN THE MECHANICAL PROPERTIES

KIM Hansoo, KIM Sang-Heon, KWON Se-Kyun, KIM Nack J.

POSTECH / GIFT, Pohang, Republic of Korea

Abstract

A necessity of ever-more efficient use of energy and fuel in cars and machines has triggered the compelling demands for various lightweight structural materials. Steel remains most competitive and most widely used as engineering materials due to its abundance and versatility. But, it is now facing challenges from alternative lightweight solutions such as fiber-reinforced-plastic, magnesium, aluminium and/or titanium alloys. This situation is driven by the low strength-to-weight ratio (specific strength) of iron and steel, and the desire to improve such mechanical properties with other materials. Recent studies on low-density steels have revealed the effectiveness of alloying aluminium in increasing the specific strength by reducing density. However, the formation of brittle intermetallic compounds such a s FeAl (B2) and Fe3Al (DO3), with increasing aluminium content to further reduce the density, leads to poor ductility. Early this year, in a paper published in Nature (nature.com/articles/doi:10.1038/nature14144), we have shown that an FeAl-type brittle but hard intermetallic compound (B2) can be effectively used as a strengthening second phase in high-aluminium low-density steel, while alleviating its harmful effect on ductility by controlling its morphology and dispersion. However, the phase transformation mechanism during annealing of FCC/B2 dual-phase sheet steel is not clear. In this contribution, we report the evolution of microstructure during annealing of cold-rolled FCC/B2 dual-phase steel, trying to clarify the phase transformation mechanism based on the results of XRD, SEM and TEM. Finally, we correlate the microstructural changes with those of the mechanical properties.

Keywords: FCC/B2-duplex steel, specific-strength, ordering, low-density

Author did not supply full text of the paper/poster.