

8th International Conference on Physical and Numerical Simulation of Materials Processing (ICPNS)

14–17 October 2016

Seattle, Washington | Hosted by Purdue University

SESSION 5: IRON AND STEEL, HARBOR HALL

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SUNDAY, OCTOBER 16, 2016

The effect of Mn and Cr on the microstructures and mechanical properties of nanobainite steels

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ABSTRACT

The effects of Mn and Cr on low-temperature bainitic transformation kinetics, microstructures, and mechanical properties in high-carbon Si–Al-rich alloy steel were determined using dilatometry, optical microscope (OM), scanning electron microscopy (SEM), X-ray diffraction (XRD), and tensile tests. The results showed that Mn and Cr would extend bainitic incubation period and completion time. And with the increase of Mn and Cr, the bainitic ferrite plate thickness decreased and the volume fraction of retained austenite increased. TRIP effect was observed during tensile testing which improved the overall mechanical properties. The increase of Mn can improve the strength to a certain extent, but reduced the ductility. The increase of Cr can improve the ductility of nanobainite steels which transformed at a low-temperature. Nanobainitic steel, which was austempered at 230C, exhibited excellent mechanical properties with ultimate tensile strength of 2146 MPa, total elongation of 12.95%.

KEYWORDS: nanobainite, retained austenite, TRIP effect