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THE ROLE OF AUSFORMING ON PHASE TRANSFORMATION KINETICS OF NANOBAINITE DURING CONTINUOUS COOLING TRANSFORMATION

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ABSTRACT

Demand for high-strength steel is increasing due to the advancement of technology and it encouraged scientists to develop new high strength materials at the shortest possible transformation time as it is one of the critical issues on the practical application of high strength steel. In this paper, the effects of ausforming on phase transformation kinetics and development of microstructure during the continuous cooling transformation of nanobainite were examined by dilatometry, metallographic method, and X-ray diffraction. The dilatometric analysis was done via Gleeble 3800-GTC to determine the suitable heat treatment procedure. Samples were continuous cooled at different rates to investigate the cooling rate suitable for bainitic transformation. Among various cooling rates 0.03°C/s was found to be suitable for nanobainite transformation as it avoids the formation of martensite and pearlite. The Combination of continuous cooling at 0.03°C/s and deformation with strain rate of 0%, 20% and 30% at 500°C increases volume fraction of bainite from 67% to 79%. Phase transformation kinetics of nanobainite due to ausforming followed by continuous cooling was found to be increased due to the dislocation debris generated by the plastic deformation which acts as nucleating sites for bainite. Ausforming process affects both the nucleation and growth process. Firstly, the deformation increases dislocation density due to which nucleation sites for bainitic ferrite increases. Secondly, the growth process of bainite laths is limited due to the dislocation debris introduced by the deformation of samples. In the present work, the overall transformation rate is dominated by the nucleation rate results in an increase in the volume fraction of bainite. The results show that deformation of austenite prior to continuous cooling increases the volume fraction of bainite and thus it increases phase transformation kinetics of nanobainite.

Keywords: nanobainite, phase transformation kinetics, microstructure, heat treatment

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