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Low-temperature bainite transformation behavior and microstructure and mechanical properties of a medium-carbon high-strength steel for railway forging upper core plate

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ABSTRACT

The main research object of this dissertation is a new medium-carbon low-alloy high-strength steel material with bainitic microstructure characteristic for forging upper core plate which used at heavy haul railway. In order to provide basic data for the physical simulation of the isothermal quenching process of test steel, the isothermal transformation dynamics curve and phase transformation points, Ac1, Ac3, and MS of the steel was both simulated using the software and measured by physical simulation. Then investigate the microstructure characteristic and mechanical properties of the steel processed by austempering according to the curve. Results show that transformation points, Ac1, Ac3, and MS, are determined as 768, 830, and 210°C. The bainitic transformation was carried out in a temperature range of 210,277°C. The low-temperature bainitic microstructure is composed of lath-like bainitic ferrite and film-like retained austenite can be formed in the steel by isothermal transformation in this temperature range. In addition, the optimum comprehensive properties is obtained in the sample isothermally transformed at 265°C, that is, the hardness is 512HV0.5, tensile strength is 1859 MPa, the yield strength is 1232 MPa, and the impact toughness is 63.8 J/cm^2.

KEYWORDS: medium-carbon, isothermal transformation kinetics, low-temperature bainite, microstructure, mechanical properties