THE EFFECT OF STEPPED AUSTEMPERING ON PHASE COMPOSITION AND MECHANICAL PROPERTIES OF NANOSTRUCTURED X37CrMoV5-1 STEEL

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Abstract

This paper presents the results of studies of X37CrMoV5-1 steel subjected to a nanostructuring process consisting on one- and two-step isothermal quenching. The Transmission Electron Microscopy (TEM) observations showed that steel after one-step quenching consisted of carbide-free bainite plates of nanometric width separated by thin layers of austenite. The microstructure contained also austenite blocks partially transformed into martensite during final quenching to room temperature. The high content of austenite led to high plasticity and moderate strength of steel. In order to improve the strength parameters, it was necessary to reduce the content of austenite. To achieve this goal an innovative heat treatment consisting on two-step isothermal quenching was proposed. The parameters of this process were designed basing on the results of dilatometric tests. The second step of the isothermal quenching was set below the initial Ms temperature. No martensitic transformation was recorded during the dilatometric tests, because of gradual carbon-enrichment of austenite during the first step of bainitic transformation. By use of magnetic tests and TEM observations it was shown, that the two-step heat treatment led to an increase in the bainitic ferrite content, which resulted in an improvement of strength with no decrease of the plasticity of steel.

Keywords: Heat treatment, austempering, steels, nanobainite, dilatometric test

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