Influence of chemical composition and parameters of heat treatment on the mechanical properties and microstructure of TRIP steels

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Abstract:

Good mechanical properties of steels, in which appropriate heat treatment can produce mixed hardening structures, make them candidates for a broad range of applications, namely in the automotive industry. TRIP steels (in which transformation-induced plasticity operates) with a carbon content of approximately 0.2% are one such class of steels. Heat treatment of these steels comprises two stages. The first involve heating to the intercritical region between the A1 and A3. It is followed by cooling to a bainitic transformation temperature and holding. The resulting mixed microstructure consist of ferrite, bainite and retained austenite. Thanks to the presence of ferrite and retained austenite, the ultimate strength and elongation can reach 1500 MPa and 25-40%, respectively. The experiments presented in this paper were performed on two steels whose chemistries were specially adjusted to support formation of TRIP microstructure. The main difference between them was the level of chromium. Intercritical annealing was carried out on both steels. Aspects of interest included mainly the effect of the cooling rate above the bainitic transformation temperature and the holding time on mechanical properties and final microstructure. The heat treatment led to microstructures ferrite, bainite and retained austenite. The strength was under 1100 MPa and elongation reached 28%.

Key words:

TRIP steels, retained austenite, X-ray diffraction, intercritical annealing