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**Effect of deep cryogenic treatment on structure-property
relationship in an ultrahigh strength Mn-Si-Cr bainite/martensite
multiphase rail steel**

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Abstract

The bainite/martensite (B/M) multiphase microstructure was studied in 0.22C- 2.0Mn- 1.0Si- 0.8Cr- 0.8(Mo + Ni) (wt. %) bainitic steel subjected to deep cryogenic treatment (DCT) to elucidate the positive effect of DCT on structure and mechanical properties. The study indicates that DCT can improve mechanical properties and wear resistance. It reduces the content of blocky martensite/austenite (M/A) constituents by eliminating unstable retained austenite (RA). At the same time, RA is relatively more enriched in carbon after DCT, compared to the tempering process. During DCT, the brittle martensite is also avoided, since the enhanced recovery reduces the carbon concentration during tempering. Meanwhile, the contraction of unit cell at low temperature promotes the precipitation of fine dispersed carbides and contributes to wear resistance.

Keywords: deep cryogenic treatment, bainite, microstructure, properties

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