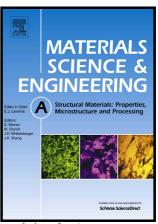
### Author's Accepted Manuscript

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www.elsevier.com/locate/msea

PII: S0921-5093(16)31602-1

DOI: http://dx.doi.org/10.1016/j.msea.2016.12.100

Reference: MSA34531

To appear in: Materials Science & Engineering A

Received date: 14 October 2016 Revised date: 21 December 2016 Accepted date: 22 December 2016

Cite this article as: Kaikai Wang, Zhunli Tan, Kaixuan Gu, Bo Gao, Guhui Gao R.D.K. Misra and Bingzhe Bai, Effect of deep cryogenic treatment on structure property relationship in an ultrahigh strength Mn-Si-Cr bainite/martensit multiphase rail steel, *Materials Science & Engineering A* http://dx.doi.org/10.1016/j.msea.2016.12.100

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#### **ACCEPTED MANUSCRIPT**

# 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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#### <u>Abstract</u>

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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