Accepted Manuscript

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PII:	S1044-5803(18)30747-2
DOI:	doi:10.1016/j.matchar.2018.05.056
Reference:	MTL 9253
To appear in:	*Materials Characterization*
Received date:	27 March 2018
Revised date:	28 May 2018
Accepted date:	29 May 2018

Please cite this article as: Vahid Javaheri, Nasseh Khodaie, Antti Kaijalainen, David Porter , Effect of niobium and phase transformation temperature on the microstructure and texture of a novel 0.40% C thermomechanically processed steel. Mtl (2017), doi:10.1016/j.matchar.2018.05.056

Effect of Niobium and Phase Transformation Temperature on the Microstructure and Texture of a Novel 0.40 % C Thermomechanically Processed Steel

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Abstract:

Field emission scanning electron microscopy, electron backscatter diffraction (EBSD) and X-ray diffraction (XRD) have been employed to investigate the effect of niobium and phase transformation temperature on the evolution of microstructure and texture in a novel thermomechanically processed, medium-carbon, low-alloy steel intended for slurry pipeline applications. Thermomechanical processing consisted of hot-rolling in the austenitic region with deformation both above the recrystallization limit temperature and below the recrystallization stop temperature. Immediately after rolling, specimens were directly quenched in water to two different temperatures of 560 ℃ and 420 ℃ and subsequently furnace cooled from those temperatures to simulate the cooling of coiled strip on a hot strip mill. The microstructure of samples quenched to 560 ℃ mostly comprised of upper bainite, whereas the samples quenched to 420 ℃ mainly consisted of lath-type lower bainite. The transformation texture of all samples at the mid-thickness position consisted of α, γ and ε-fibers with high intensities close to the transformed copper, transformed brass and rotated cube components. The addition of 0.013 wt.% Nb refined the microstructure and sharpened the texture. The texture of the small fraction of retained austenite present in the final microstructures indicated that the main bcc texture components result from the brass and copper components in the parent austenite.

Key words: Texture, Hot rolling, Microstructure, Medium carbon steel, Niobium