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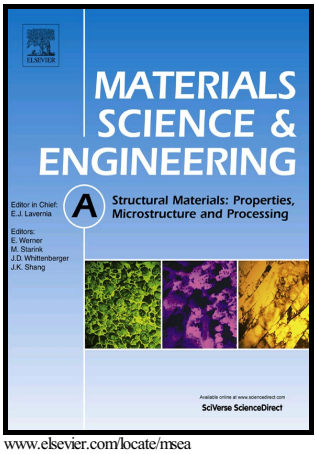

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Asymmetric distribution of microstructure and impact toughness in stir zone during friction stir processed a high strength pipeline steel

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Abstract: A high strength pipeline steel was successfully friction stir processed at high, medium and low heat input processing parameters. The microstructural evolution on advancing side and retreating side of the stir zone was studied using a combination of optical microscopy, scanning electron microscopy, electron backscattered diffraction and transmission electron microscopy. The microstructural observations suggested that the prior austenite grain size, bainite morphology, texture components and impact toughness were distributed asymmetrically on the advancing side and retreating side at high and medium heat input. This was caused by asymmetric distribution and change in temperature and strain rate. While, the entire stir zone at low heat input was characterized by uniform microstructure and excellent impact toughness. Therefore, the microstructure and impact toughness on the advancing side and retreating side was closely related to processing parameters.

Key words: friction stir processing, high strength pipeline steel, asymmetrical distribution, microstructure, impact toughness