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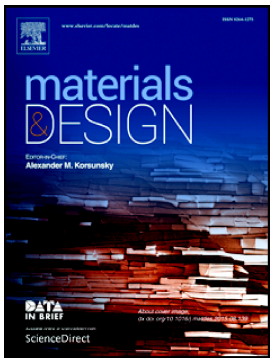

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Liquid Metal Embrittlement in Laser Beam Welding of Zn-Coated 22MnB5 Steel

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Abstract

Despite frequent reports of liquid metal embrittlement (LME) during resistance spot welding, no work has been done to investigate the LME sensitivity in laser beam welding (LBW) of advanced high strength steels. The present study was therefore undertaken to reflect the LME sensitivity of Zn-coated 22MnB5 press-hardening steel as a function of stress intensity and heat input during LBW. The results proved a direct relation between the external load and LME susceptibility, where the threshold tensile stress of about 80%YS is necessary to trigger the embrittlement. Electron backscatter diffraction (EBSD) in conjunction with electron probe micro-analyzer (EPMA) results confirmed the intergranular penetration of Zn along the prior austenite high-angle grain boundaries in upper-critical heat affected zone (UCHAZ). The presence of Zn over the maximum Zn-solubility of austenite promotes α-Fe(Zn) transformation along the LME-crack which assists the loss of ductility. The present findings provide an understanding of the mechanism of embrittlement in UCHAZ and suggest solutions to mitigate the LME in LBW of boron steels.

Keywords: Liquid Metal Embrittlement; Laser beam welding; Press-hardening steel; Microstructure; Zn.

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