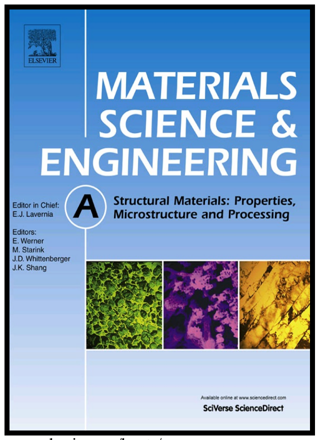

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The role of the microstructure on the influence of hydrogen of some advanced high-strength steels

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Abstract

The role of microstructure was studied for dual-phase (DP), quenched and partitioned (Q&P), and twinning induced plasticity (TWIP) steels. The hydrogen influence changed the fracture mode at the ultimate tensile strength, there being no subcritical crack growth at a lower stress. The fractures initiated (i) in the hard martensite and/or at the interfaces of ferrite and martensite for DP steels, (ii) in the martensite and/or at the interfaces of retained austenite and martensite for Q&P steels, and (iii) at mechanical twins for TWIP steels. Tempering may improve the resistance to hydrogen of DP and Q&P steels.

Key words: advanced high strength steel; SEM; microstructure; hydrogen embrittlement

1. Introduction

The Dual Phase (DP), Quenched and partitioned (Q&P) and Twinning-Induced Plasticity (TWIP) advanced high-strength steels (AHSS) are good candidates for manufacturing car components for weight reduction and improved safety [1-4]. However, these AHSS may be influenced by hydrogen [5], which may cause decreased mechanical strength and decreased ductility [6-10]. Our previous research [11, 12] showed that the influence of hydrogen on some commercial DP, Q&P and TWIP steels was manifested by (i) a somewhat decreased yield strength (by 1% to 20%), (ii) a reduced ductility caused by hydrogen assisted fracture processes occurring after the onset of necking at the ultimate tensile strength of the steel. Furthermore, the magnitude of the hydrogen influence increased with increasing strength, decreasing applied stress rate, and increasing hydrogen fugacity.