Effect of Carbon Content and Microstructure on the Diffusion of Hydrogen in Low Carbon Steels

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In this work, the electrochemical permeation technique proposed in the ASTM-G148-97 Ed 2011 standard was used to determine the maximum oxidation current density, i_{max} ; breakthrough time; t_b , effective hydrogen diffusion coefficient, D_{eff} ; and surface hydrogen concentration, C_H^0 , for several API 5L steels. The results show that steels with a carbon content of less than or equal to 0.052 %wt and a ferritic-bainitic microstructure have higher D_{eff} and i_{max} values than steels with a higher carbon content and a ferritic-pearlitic microstructure, while the C_H^0 and t_b parameters show a clear tendency to decrease when the microstructure changes from ferritic-pearlitic to ferritic-bainitic. The D_{eff} values obtained in this work are consistent with published data, both in terms of their magnitude and in relation to the effects of carbon content and microstructure.

Keywords: hydrogen diffusion, diffusion equations, Electrochemical Permeation Technique.

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