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Can Charpy impact testing (high strain rate) detect the presence of hydrogen in high strength steels?

Hydrogen was intentionally introduced into ultra-high strength steel by cadmium plating. The purpose was to examine the effect of cadmium plate thickness, and hence, hydrogen on the impact strength of the steel. The AISI 4340 steel was austenitized at 1000°C for 1 hour, water quenched, and tempered at temperatures between 494 and 1100°C in order to achieve a range of targeted strength levels. The specimens were cadmium plated with 0.00508 mm (0.2 mils), 0.00762 mm (0.3 mils), and 0.0127 mm (0.5 mils). Results demonstrated that the uncharged specimens exhibited higher impact energy values when compared to the plated specimens at all tempering temperatures. The results of this work are best explained by the dislocation transport (sweeping) of hydrogen model.

Recent Publications

1. Z Zupin and K Dimitrovski (2010) Mechanical properties of fabrics from cotton and biodegradable yarns, bamboo, SPF, PLA in weft. Woven Fabric Engineering 25-46.
2. S Es-Said, J Foyos, R Noorani, M Mendelson and B Pregger (2000) Effect of layer orientation of mechanical properties of rapid prototyped samples. Journal of Materials and Manufacturing Processes 15(1):107-122.
3. V Vega, Clements J, Lam T, Abad A, Fritz N, Ula N and O S Es-Said (2011) The effect of layer orientation on the mechanical properties and microstructure of a polymer. Journal of Material Engineering and Performance 20(6):978-988.
4. Montgomery, Douglas C and George Runger (1994) Probability and Statistics for Engineers. N.p.: Wiley 74.

Biography

Omar S Es-Said is a Professor in Mechanical Engineering Department at Loyola Marymount University in Los Angeles, California. He was an Assistant Professor from 1985-1992, Associate Professor from 1992-1998, and Full Professor from 1998-present at Loyola Marymount University in Los Angeles, California. He has completed his BS in Physics and MS in Solid State Physics at The American University in Cairo. He has completed his PhD in Metallurgical Engineering and Materials Science at the University of Kentucky, Lexington in 1985. His current research interests include "Metallic processing, modeling, experimental, techniques, and failure analysis". He has published over 300 papers, which included refereed journal articles, conference proceedings, industrial reports, and Department of Defense (DoD) reports. He has been an Associate Editor from 2008-present for the American Society of Materials (ASM), Journal of Materials Engineering and Performance (JMEP). He has been the Editorial Board Member of the Engineering Failure Analysis Journal from 2003-present. He has received several awards. He was a Consultant for the Navy from 1994-present. He was hired as a Distinguished Summer Faculty Fellow at The Navy Facilities Engineering Services Center (NFESC) in the summers of 2010-2017. He became an American Society of Materials (ASM) Fellow in 2005.

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