

## Correlation Between Hydrogen Charging and Charpy Impact of 4340 Steel

**Authors :** J. Alcisto, M. Papakyriakou, J. Guerra, A. Dominguez, M. Miller, J. Foyos, E. Jones, N. Ula, M. Hahn, L. Zeng, Y. Li, O. S. Es-Said

**Abstract :** Current methods of testing for hydrogen charging are slow and time consuming. The objective of this paper was to determine if hydrogen charging can be detected quantitatively through the use of Charpy Impact (CI) testing. CI is a much faster and simpler process than current methods for detecting hydrogen charging. Steel plates were Electro Discharge Machined (EDM) into ninety-six 4340 steel CI samples and forty-eight tensile bars. All the samples were heat treated at 900°C to austenite and then rapidly quenched in water to form martensite. The samples were tempered at eight different target strengths/target temperatures (145, 160, 170, 180, 190, 205, 220, to 250KSI, thousands of pounds per square inch)/(1100, 1013, 956, 898, 840, 754, 667, 494 degrees Celsius). After a tedious process of grinding and machining v-notches to the Charpy samples, they were divided into four groups. One group was kept as received baseline for comparison while the other three groups were sent to Alcoa (Fasteners) Inc. in Torrance to be cadmium coated. The three groups were coated with three thicknesses (2, 3 and 5 mils). That means that the samples were charged with ascending hydrogen levels. The samples were CI tested and tensile tested, and the data was tabulated and compared to the baseline group of uncharged samples of the same material. The results of this study were successful and indicated that CI testing was able to quantitatively detect hydrogen charging.

**Keywords :** Charpy impact toughness, hydrogen charging, 4340 steel, Electro Discharge Machined (EDM)

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