

Influence of Decarburization on the Local Corrosion Behavior of the SAE 9254 Spring Steel

Jéssica Cristina Costa de Castro Santana¹, Rejane Maria Pereira da Silva², R. A. Antunes³, Sydney Ferreira Santos³

¹Universidade Federal do ABC, ²Instituto de Pesquisas Energeticas e Nucleares (CENEN-SP), ³Universidade Federal do ABC (CECS)

e-mail: jes_crist@hotmail.com

Decarburization is an unwanted metallurgical phenomenon comprising the loss of carbon from the steel through outward diffusion and oxidation on the surface at high temperatures. As this phenomenon leads to phase transformations in a small region close to the surface, it is likely expecting some effects on the local chemical reactivity of the steel. This, in turn, would account for the appearance of preferential anodic sites that can act as localized corrosion spots. Macroscopic corrosion symptoms, observed by conventional corrosion techniques, express only the final step of a complex and dynamic sequence that begins at the microscopic level. Several localized electrochemical techniques can be used to characterize local corrosion processes. One of them is the scanning electrochemical microscopy (SECM). The aim of the present work was to study the surface chemistry, microstructure and local corrosion processes at the decarburized layer of the SAE 9254 automotive spring steel. The samples were austenitized at 800, 850, 900 and 950 °C followed by oil quenching. The microstructure was investigated using confocal laser scanning microscopy and scanning electron microscopy. The surface chemistry was analyzed by X-ray photoelectron spectroscopy. The local electrochemical activity was probed by SECM. Microstructural characterization and XPS analysis indicate a dependence of the local electrochemical processes with the steel microconstituents and also Si and Cr oxides formed during heat treatments. The presence of the ferritic layer enhanced the multiphase character of the steel microstructure in the region of partial decarburization of sample A900, increasing iron oxidation and, therefore, the local electrochemical activity for this condition.

Acknowledgements: The authors would like to thanks PPG-Nano - UFABC, DAI - CNPq, and Thyssenkrupp Brazil.