Quantitative Analyses of the Severity of Attack on Crevice Corrosion Surfaces

A. J. Hodges, R. G. Kelly
Center for Electrochemical Science and Engineering
Department of Materials Science and Engineering
University of Virginia
Charlottesville, VA 22904

The analysis of the results of crevice corrosion testing for stainless steels and other corrosion resistant metals has primarily been qualitative. Due to the localized nature of the attack, mass loss measurements must be interpreted with great care. In addition, such measurements provide very limited information regarding the spatial distribution of the damage which can be of critical importance to the effects of the corrosion on structural integrity. The application of confocal laser scanning microscopy (CLSM) to corroded surfaces allows quantitative examination. CLSM provides a quantitative topographical map with a spatial resolution on the micron scale in all three dimensions. An example of such a map from a crevice corroded sample of C-22 [1], along with a single line scan, is shown in Figure 1. The image is from one "foot" of a multiple crevice assembly. Analyses of such data allow the calculation of a number of parameters of interest, including but not limited to the volume lost, the maximum depth of attack, and the auto correlation function. The autocorrelation function provides information concerning the periodicity of surface features. Examples of the application of these analyses to quantitative evaluation of the effects of experimental parameters as well as validation of crevice corrosion models will be presented.

Acknowledgements

This work was supported by the Office of Science and Technology and International of the United States Department of Energy (DOE) and carried out as part of the DOE Multi-University Corrosion Cooperative under Cooperative Agreement DE-FC28-04RW12252.The funding agency is gratefully acknowledged.

[1] K. Mon, G. Gordon, R. Rebak, "Stifiling of Crevice Corrosion in Alloy 22." 12th International Conference on Environmental Degredation of Materials in Nuclear Systems-Water Reactors, Salt Lake City, UT, 8/14/05-8/18/05.

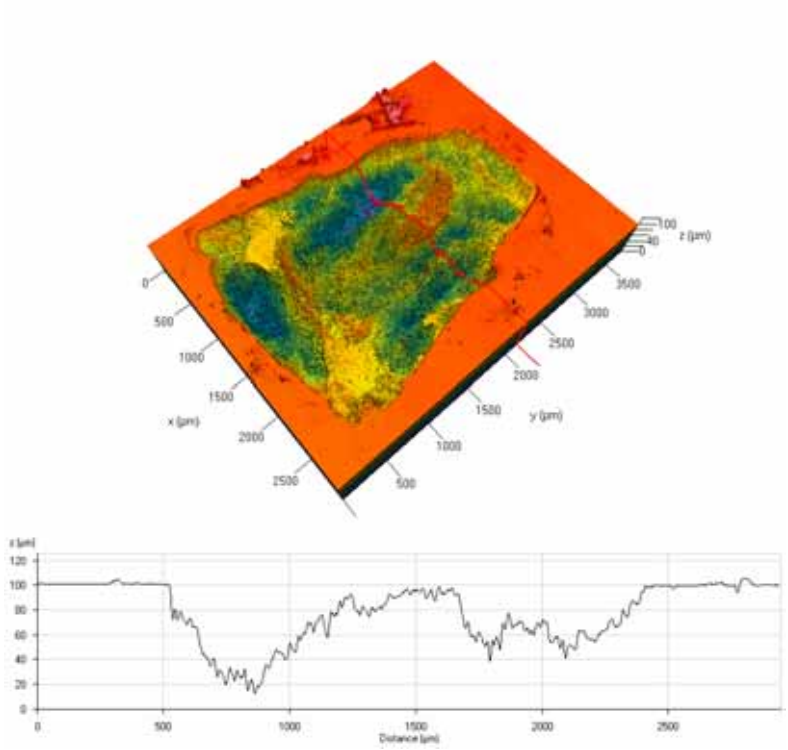

Figure 1: Topographical map of a single foot and a line scan at the position indicated from a multiple crevice assembly sample of C-22 corroded for 168 h in a 3.5m NaCl + 0.175m KNO_3 solution with a 100mV SSC applied potential at 100^{o}C [1].