

Corrosion behavior of friction stir welded API X70 steel joints

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The ever-increasing demand for fossil fuels has pushed the oil and gas industry to search for new deep water wells and in more aggressive environmental conditions, such as the pre salt where the presence of CO₂ and H₂S concentrations, has led to the development of new materials and manufacturing processes. For pipeline construction, Friction Stir Welding (FSW) process is a promising candidate to be used in the girth welding procedure, and research studies must be carried out to understand the effect of this new processing on the pipeline life under the in-service conditions (environment, fatigue). The present work is part of a research project aiming to investigate the effect of a saline environment on the mechanical properties of an API-5L-X70 steel, welded by FSW. Therefore, in this work, the results of the corrosion behavior analysis carried out on the FSW welded joint, considering a 3.5% NaCl solution, are presented. The corrosion behavior was investigated based on potentiodynamic polarization tests on the different regions of FSW welded joint, i.e., the base metal (BM) and stirred zone (SZ). Gel visualization tests, considering the whole welded joint, were also conducted. The two FSW regions showed similar polarization curves in terms of corrosion potential (E_{corr}), corrosion current density (i_{corr}) as well as anodic current density values. In the gel tests, a preferential localized attack on any of the regions of the FSW welded joint was not observed. These results can be interpreted as evidence that the corrosion behavior of the FSW welded joint was not significantly affected by the different metallurgical microstructures formed by the FSW processing.

Acknowledgements: One of the authors would like to acknowledge the National Council for Scientific and Technological Development, CNPq, "Scholarship - Brazil". Process: 165065/2017-6. The authors would like to thanks the SMM, EESC-USP and the LNNano/CNPEM - Centro Nacional de Pesquisa em Energia e Materiais.