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A comprehensive assessment of the performance of corrosion resistant alloys in hot acidic brines for application in oil and gas production

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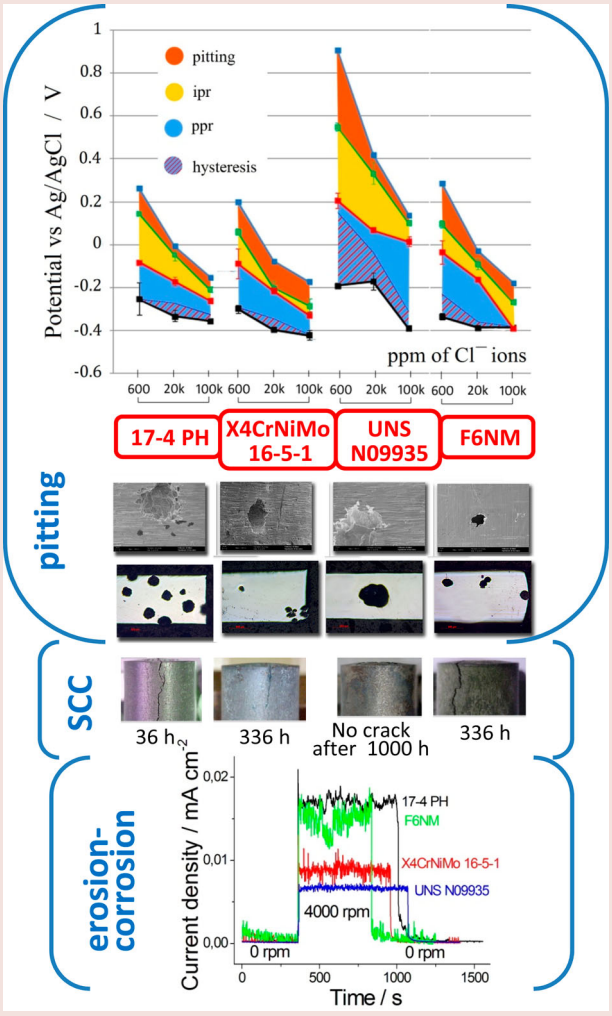
ABSTRACT

Four stainless steels and alloys (17-4 PH, X4CrNiMo 16-5-1, F6NM and UNS N09935) were evaluated in relation to their application in the oil and gas industry. These materials were tested in solutions exhibiting a range of chloride concentrations, pH values and temperatures of interest for the oil and gas producing environments. The pitting sensitivity was investigated by means of potentiodynamic polarisation measurements, based on the ASTM G61 standard, in conjunction with a morphological study performed by scanning electron and optical microscopy. The resistance to stress corrosion cracking (SCC) was evaluated in compliance with the ASTM G123 standard. Erosion–corrosion was assessed by exposing the materials under electrochemical control to a flux of erodent glass microspheres in a rotating disc electrode device. A ranking of the materials resistance was derived, based on appropriate parameters, devised to effectively and synthetically represent the complex sets of environments of interest for the relevant application. Our results showed, as expected, that UNS N09935 displays the best performance with respect to pitting resistance and susceptibility to SCC as well as a very good resistance to erosion–corrosion. Among the other investigated materials, 17-4 PH showed higher resistance to pitting, X4CrNiMo 16-5-1 and F6NM longer time to SCC failure while 17-4 PH and X4CrNiMo 16-5-1 exhibited superior ability to withstand erosion–corrosion damaging.



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