Localized Corrosion Behaviour of FeCrAl Nuclear Fuel Cladding in Pool Storage

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The international materials community is engaged in finding safer alternatives to zirconium alloys in light water reactors. One solution is to replace the zirconium cladding of the nuclear fuel using iron-chromium-aluminum -FeCrAl- alloys, which offer extraordinary resistance to high temperature reaction with air or steam due to the formation of a protective alumina layer on the external surface. It is important to characterize the behavior of FeCrAl not only during accident conditions but in the entire fuel cycle, which may include the cooling for 5-20 years in water pools before the fuel bundles are shipped to dry cask storage. The main mode of corrosion in water pools could be general corrosion and localized corrosion such as pitting, crevice and environmentally assisted cracking. Current results show that FeCrAl alloys would be resistant to corrosion in the cooling pools. Electrochemical tests showed that both FeCrAl APMT and C26M remain passive in 3.5% NaCl solution, which is highly more aggressive than the environments in the actual pools. Results also show that the localized corrosion resistance of FeCrAl followed the behavior given by the pitting resistance equivalent (PRE). APMT was more resistant to localized corrosion than type 304H SS and C26M has a similar resistance to localized corrosion than type 304H SS.