Experimental And Numerical Simulation Of Pits On A Corroded 316L Grade Stainless Steel

E.SASSINE[1], P.NAMY[1], V. BRUYERE[1], J. ROSEC[2], R. FARGERE[2]

[1]SIMTEC, Grenoble, France
[2]Naval-Group, France

Abstract

Corrosion is an ongoing issue in metallurgic field. Stainless-steel products are likely to corrode in certain environmental conditions, especially if they are exposed to marine environment where localized corrosion can occur. The aim of this work is to study the behavior of 316L grade stainless steel subjected to pitting corrosion in a marine solution. The originality of this paper is that chemical kinetics parameters used in numerical simulation are based on experimental campaign in artificial seawater. Pitting initiation mechanism is not be treated in this paper and the main interest is focused on pits development. 2D Axisymmetric simulations in transient mode were accomplished thanks to COMSOL Multiphysics® software. The analysis of the experimental measurements indicates that mean width and depth of pits are relatively close, so pits can be considered as a hemisphere. Numerical results show that pit propagation depends on its initial form. A hemispherical pit keeps its shape during propagation (only its radius increases over time) while an ellipsoid pit has a different behavior.

Figures used in the abstract

Figure 1 : Numerical simulation results showing pH distribution and pit's shape after 30 years

Figure 2 : evolution of pit shape during a period of 20 years