Metastable Pitting on 304 Stainless Steel in Cement Extract Solution with Different Concentration of Cl^-

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Metastable pitting behavior of 304 stainless steels in cement extract solution (pH 8) with various concentration of Cl^- was studied by Mott-Schottky plot, potentiodynamic polarization, and potentiostatic polarization, respectively. Nucleation rate and the probability of transformation from metastable to stable pitting on the stainless steel significantly increased when the concentration of Cl^- increased. The growth rate and re-passivation rate of individual metastable pitting also increased with the concentration of Cl^- in the carbonated cement extract solution. Interestingly, differing from the widely accepted view that the type of metastable pitting is characteristic of the kinds of metals or alloys and the type is not affected by the solution environment, in the present study, the types of metastable pitting on the 304 stainless steel gradually transformed from Type II to Type I when the concentration of Cl^- increase in the pore solution. Additionally, high donor density suggests that the passive film has a high susceptible of pitting, but it may enhance the rate of passivation in the subsequent passivation process for the steel in the cement extract.

Keywords: stainless steel; pore solution; metastable pitting; growth rate; re-passivation rate

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