A novel in-situ device for studying the mechanism of the effect of electrode area ratio on crevice corrosion

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Abstract Crevice corrosion (CC) is one of the common forms of localized corrosion damage to stainless steel (SS). Evaluation and prediction of the incubation stage (τ) is the key to study the CC problem of SS [1,2]. It is particularly important to investigate the mechanisms by which crevice geometry affects the duration of the CC's τ [3]. To guarantee accurate control over the geometry of the crevice and to monitor the structural evolution of corrosion products and corrosion rates within crevices in-situ, an appropriate CC simulation test device should be has been designed. The influence law of cathode to anode area ratio (S_c/S_a) on the duration of 304 SS's CC incubation period (τ) was monitored in real time using current noise. And the relationship model between S_c/S_a and the duration of τ was established. The magnitude of τ in CC was found to show a positive correlation with the value of S_c/S_a. The τ of CC becomes progressively shorter as the ratio increases, τ=11.5 hrs as S_c/S_a=1, and τ=3.1 hrs as S_c/S_a=25. The increase in S_c/S_a can increase the susceptibility of CC. The pH distribution within the crevice varied significantly with time under different S_c/S_a conditions. This leads to the growth of different corrosion product of 304 SS at different stages of CC.

Keywords in-situ monitoring, corrosion, oxidation, simulation and modelling, evolution of hydrochemistry

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