

Investigation of a single pit generated with a flow microcell

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Pitting corrosion has been widely studied in the last decades on stainless steel, but since it results in a random succession of single or multiple events at the metal surface, it remains difficult to study experimentally. It is thus necessary to work on a single pit for a better understanding of mechanisms governing pitting from its initiation to the propagation or its repassivation [1-3].

This work aims at bringing new insight on the pit propagation description on 316L stainless steel. In a first step, we will describe the experimental setup allowing to generate and to sustain a single pit (Figure 1 – left). Then, the propagation phase will be investigated (Figure 1 – right) and a particular attention will be paid to the description of both radial and deep evolutions. It will be also shown that electrochemical impedance spectroscopy can be performed on a single pit.

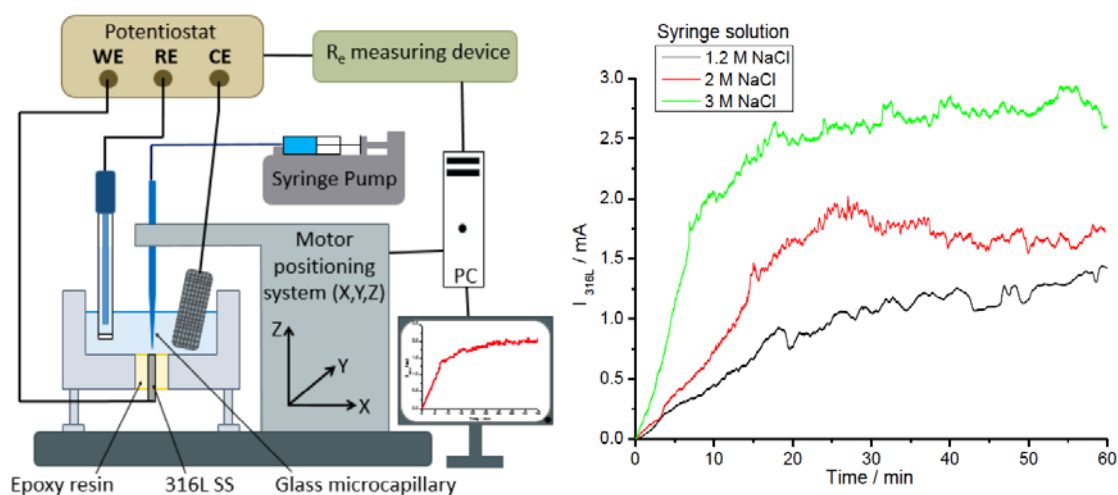


Figure 1: Electrochemical device developed for generating a single pit (left) and example of current time curves for three single pits after 1 hour propagation at 0 V/MSE with the chloride concentration as a parameter (right).

- [1] K. Fushimi, M. Seo, Study on a local breakdown process of passive film on iron by a liquid-phase ion-gun, Proceedings - Electrochemical Society 99-28 (2000) 362-9.
 [2] N. Aouina, F. Balbaud-Celerier, F. Huet, S. Joiret, H. Perrot, F. Rouillard, V. Vivier, Single pit initiation on 316L austenitic stainless steel using scanning electrochemical microscopy, Electrochim. Acta 56 (2011) 8589-96.
 [3] N. Aouina, F. Balbaud-Celerier, F. Huet, S. Joiret, H. Perrot, F. Rouillard, V. Vivier, Initiation and growth of a single pit on 316L stainless steel: Influence of SO₄²⁻ and ClO₄⁻ anions, Electrochim. Acta 104 (2013) 274-81.

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