Application of cyclic potential pulse technique to study pitting initiation mechanism and enhance pitting resistance of stainless steel

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Abstract The Ti-stabilized 321 stainless steel (SS 321) is widely used in the primary pipe and reactor internals of nuclear power plants due to its mechanical properties and corrosion resistance at high temperature. However, it inevitably encounters pitting when exposed to aggressive chloride ions in the marine environment. In this work, the inclusion type and pitting behavior of SS 321 in NaCl solution are studied. The initial stage of pitting is investigated by potentiostatic pulse technique (PPT), which controls the pit size. Pure TiN inclusion and complex inclusion with core-shell structure are two main inclusion types. The former has no effect on the pitting resistance of SS 321. Pitting sensitivity of the complex inclusion rises with the increase of CaS content and the decrease of TiN content. The mechanism of pitting initiation induced by complex inclusions was proposed. Pitting potential of SS 321 stainless steel increased by 122 mV after PPT test.