ZrO_2 SOL-GEL COATINGS FOR STAINLESS STEEL PROTECTION IN HIGHLY CORROSIVE MEDIA

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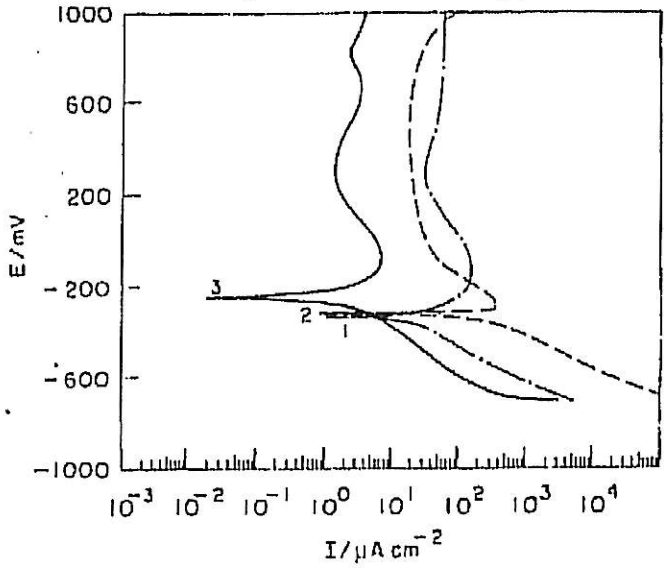
The preparation of coatings with specific chemical functions by sol-gel method offers potential advantages as it allows to tailor their structure, texture and thickness and is suitable for coating large areas at low temperature. The chemical protection of 316L Stainless Steel (SS) coated with ZrO_2 has been verified previously in air up to 1050°C by weight-gain measurements[1] and in aqueous NaCl solution (up to 200 gdm^{-3}) at 25°C by potentiodynamic curves[2]. The sol was prepared by sonocatalysis of a mixture of zirconium propoxide $Zr(OC_3H_7)_4$, glacial acetic acid, isopropanol and excess of water and aged several days[1,2]. The film was deposited at 25°C by dip coating technique and then densified in air up to 800°C for different periods of time. Preliminary weight-loss measurements in 15% H_2SO_4 have shown the stability of the coatings as well as the inhibitory effect on chemical corrosion[1].

In this work the corrosion characteristics of 316L SS immersed in deaerated 15% H_2SO_4 aqueous solutions at different temperatures was studied by potentiodynamic polarization curves. The samples used were: (1) SS as received, (2) SS heat treated at 800° C for 2 hours and (3) coated with ZrO_2 (0.5 μm) . Figure 1 ilustrate the results obtained at room temperature showing the effectiveness of the ZrO_2 coating, which produces an almost 50-fold drop in the corrosion rate (from 30.9 to 0.65 MPY). At 40° C the corrosion of SS is still strongly inhibited showing a factor of ca. 30 while at 72° C the recorded data show a much larger factor, but the results are not totally satisfactory due to interferences by the simultaneous chemical reaction. Other coatings such as mullite ($3Al_2O_3.2SiO_2$), SiO_2, TiO_2 and SiO_2-TiO_2 are currently under test.



1. Atik,M. and Aegerter, M. A. , J. Non-Cryst. Solids 147-148, 813-819 (1992)
2. Lima Neto, P.; Atik, M.; Avaca, L. A. and Aegerter, M.A.; J. Sol-Gel Sci. & Tech., submitted.