Effect of Sigma Phase Precipitation on the Pitting Corrosion Mechanism of Duplex Stainless Steels

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A new phenomenon of the pitting corrosion of three duplex stainless steels (DSSs), SAF2205, SAF2507 and Z3CN20.09M, induced by sigma phases is found and discussed. The pitting potential (E_p) of all three DSS specimens with smaller variations in the level of Cr content is remarkably higher than that of specimens with larger variations in Cr content, although they contain almost the same sigma precipitates. Even if there is much sigma phase in specimens with smaller variations in Cr content, they still present more resistance to pitting corrosion by high E_p values. The EIS results and microstructures of the DSS specimens after polarisation tests are in accordance with the potentiodynamic anodic polarisation results. The pitting of DSS induced by sigma precipitation is mainly ascribed to the level of difference in Cr content between the sigma phase and Cr-depleted zone and not only to the Cr-depleted zone itself.

Keywords: duplex stainless steel; sigma phase; Cr content difference; potentiodynamic polarisation; pitting corrosion

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