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Relation between microstructure induced by oxidation and room-temperature mechanical properties of the thermally grown oxide scales on austenitic stainless steels

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Abstract

The spalling/cracking behaviour, at room temperature, of thermally grown oxide scales under tensile stress was investigated using SEM *in-situ* tensile testing for two austenitic stainless steels with close composition except their S content. A correlation between damage patterns, microstructure, mechanical and adhesion properties of the oxide scales is proposed. The difference in microstructure evolution during oxidation between the two steels is explained in relation with the volume fraction of MnS inclusions in the substrate (i.e. S content). Although a direct effect of S content on the oxide scale adhesion is not evidenced, the metal/oxide toughness seems strongly affected by oxides features such as scale thickness, Fe content and location of internal oxides (SiO₂ along the metal/scale interface or at the grain boundaries of the underneath substrate).

Keywords

austenitic stainless steel, resulfurized steel, high temperature oxidation, tensile testing, microstructure

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