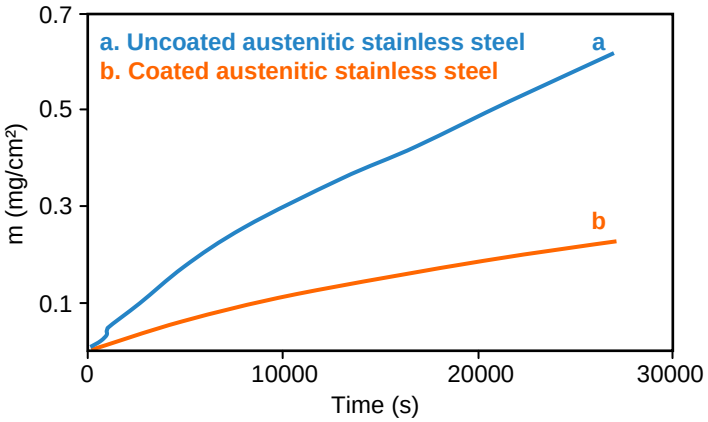
Oxidation behavior of alumina deposit on austenitic stainless steel

Reference: Preparation and characterization of electrolytic alumina deposit on austenitic stainless steel, S. El Hajjaji, M. El Alaoui, P. Simon, A. Guenbour, A. Ben Bachir, E. Puech-Costes, M-T. Maurette, L. Aries, Science and Technology of Advanced Materials 6 (2005) 519–524

Introduction: In order to protect them against oxidation at high temperature, metal and alloys are often coated by ceramic oxides such as alumina. The purpose of this paper is to study the oxidation behavior and its improvement thanks to the alumina deposit prepared by cathodic treatment of the functionalized austenitic stainless steel in an aqueous solution.



Oxidation curves at 1000℃ in air for 8 h for uncoated and coated austenitic stainless steel.

Experimental

Deposits were prepared on an austenitic stainless steel in the form of 0.5 mm x 10mm x 10mm.

Isothermal oxidation tests of uncoated and coated samples can be carried out in a Setsys Evolution TGA at 1000℃ for 8h in dynamic air at atmospheric pressure.

The total corrosion was evaluated by measuring the weight-gain as a function of heating time.

For more details, ask for publication A0618

Instrument :
Setsys Evolution TGA (ambient to 1600℃)

Results

The figure shows the weight-gain kinetics for the uncoated and coated austenitic stainless steel. We can note that the resistance of the coated sample to oxidation is higher than that of the uncoated alloy. Indeed, the studied coating induced a reduction in gain mass during thermal oxidation.

Moreover, irregular kinetics is observed for uncoated alloy, which can be attributed to the cracking or partial detachment of the oxide scale. On contrary, the thermogravimetric curve of the coated sample can be perfectly fitted to a parabola, the thermal shock resistance of the coating has been verified and no surface damage has been noted.

Therefore, the study of thermal behavior of this coated austenitic steel at 1000℃ shows that the alumina has a protector character at high temperature. The low oxidation rate is due to the presence of α alumina, which reinforces the protector character of mixed iron-chromium oxide.