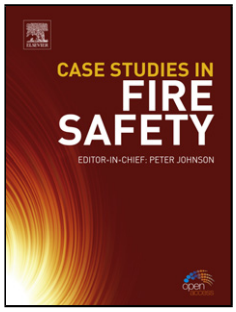

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Anomalous cyclic oxidation behaviour of a Fe-Mn-Si-Cr-Ni shape memory alloy

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Highlights

- Cyclic oxidation of a FeMnSiCrNi stainless steel was detailed by SEM, EDS and DRX
- Anomalous behaviour was observed with spallation followed by continuous mass gain
- Roughening of the Mn-depleted zone relieves the stress and improves oxide anchoring
- A roughening mechanism generated by plastic deformation of ferrite layer was proposed
- The FeMnSiCrNi alloy is an interesting candidate for cyclic oxidation applications

Abstract

Fe-Mn-Si-Cr-Ni alloys are known by their shape memory properties, however, oxidation studies are still incipient. This study evaluated an Fe-17Mn-5Si-10Cr-4Ni-VC alloy on cyclic oxidation tests at 800, 900 and 1000 °C. Mass variation was evaluated and oxide layers were examined by SEM, EDS and XRD. An anomalous mass variation was observed: after initial spallation, the material restarted mass gain. The formed Mn-depleted zone changed the austenite microstructure to ferrite on the metal/oxide interface and better oxide anchoring was promoted through the roughness generated. The result makes this alloy an interesting candidate for applications where cyclic oxidation is an important issue.

Keywords: A. Stainless steel, B. Thermal cycling, B. SEM, B. XRD, C. Oxidation