Alkaline corrosion properties of laser-clad aluminum/titanium coatings

Purpose - The purpose of this paper is to study the use of titanium as a protecting element for aluminum in alkaline conditions.

Design/methodology/approach - Aluminum coatings containing up to 20 weight per cent Ti6Al4V were produced using laser cladding and were investigated using light optical microscope, scanning electron microscope - energy-dispersive X-ray spectroscopy and X-Ray Diffraction, together with alkaline exposure tests and potentiodynamic measurements at pH 13.5.

Findings - Cladding resulted in a heterogeneous solidification microstructure containing an aluminum matrix with supersaturated titanium (1 weight per cent), Al3Ti intermetallics and large partially undissolved Ti6Al4V particles. Heat treatment lowered the titanium concentration in the aluminum matrix, changed the shape of the Al3Ti precipitates and increased the degree of dissolution of the Ti6Al4V particles. Corrosion testing showed significant localized dissolution of the aluminum matrix.

Research limitations/implications – Increased titanium concentration and heat treatment gave improved alkaline corrosion properties. At pH 13.5, the Al3Ti phases were protected, while the aluminum matrix corroded.

Practical implications – For alkaline corrosion-protection of aluminum in the automobile industry, titanium might be useful at pH values below 13.5 or by using other coating techniques.

Originality/value – This is the first study testing the use of titanium as a protective element of aluminum in stringent alkaline conditions.

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