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Enhanced high temperature oxidation of pure magnesium (Mg) by surface fluorination

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ABSTRACT

Magnesium (Mg) and its alloys are gradually used in the automotive and aviation fields due to their lightweight and easy recycling. However, the poor high temperature oxidation resistance of magnesium has limited their wider application. The high temperature performance of magnesium alloys can be improved by adding a large amount of rare earth elements, but it causes to increase the cost of magnesium alloys.

In this paper, we analyze the oxidation mechanism of pure magnesium at various temperatures in air using TG-DTA (Thermogravimetry-Differential Thermal Analysis), XPS (X-ray photoelectron spectroscopy), XRD (X-ray diffraction) and SEM (Scanning Electron Microscope) analyses. And the MgF_2 layer on Mg samples created using F_2 gas, which plays a role to prevent the oxidation of Mg even higher than 500 ^oC in air. The surface states of samples fluorinated at each temperature were investigated using XPS analysis. And the oxidation resistance of fluorinated Mg samples was checked using TG-DTA analysis. Consequently, the stable MgF_2 formed on the Mg surface can inhibit the corrosion of pure Mg metal at 500 ^oC in air, and the fluorinated Mg metal can be useful for the sintering in powder metallurgy process.

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