High-Temperature Oxidation Behavior of Fe-20Cr-4 Al Alloys with Small Additions of Cerium(Metallurgy)

An Organo-Metallic Polymer Used in Powder Metallurgy: The Effect of Polycarbosilane in Iron-Chromium Alloy

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A new material was developed by introducing an organo-metallic polymer into powder metallurgy. In the uniform mixture of Fe–13Cr* alloy powder and polycarbosilane (PC) using *n*-hexane, the Fe–13Cr particles were coated with PC. The product of Fe–13Cr+10wt%PC, obtained by hot-pressing the mixture, was subjected to an oxidation test, high-temperature hardness measurement and a wear resistance test, and found to be superior in all respects to that without the PC addition. The structure was observed by transmission electron microscope and it was found that grains of $CrSi_2$ and Cr_7C_3 about 0.1 μm in size, dispersed uniformly in the Fe–13Cr+10%PC, contributed to improvement of the mechanical properties. Observation by scanning electron microscope showed some difference in the formation of the oxidation film between Fe–13Cr and Fe–13Cr+10%PC. This new alloy, while adding an organo-metallic polymer to powder metallurgy, has several outstanding features with the possibility of many applications in the future.

Structural Changes in Amorphous $Pd_{80}Si_{20}$ by Neutron Irradiation

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Amorphous $Pd_{80}Si_{20}$ was irradiated with fast neutrons (>1 MeV) to a fluence of 5×10^{20} neutrons/cm^2. X-ray scattering intensities were measured before and after the irradiation with monochromatic Cu-$K\alpha_1$ rays. Scattered intensities for $s>0.4$Å^{-1} ($s=2\sin\theta/\lambda$) proved unaffected, while intensities were found remarkably enhanced for $s<0.4$Å^{-1} after the irradiation, i.e., in the small-angle region and the leading edge of the first halo. The results are discussed in relation to the structural anomalies in amorphous solids.

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The oxidation behavior of Fe-20Cr-4 Al alloys, some containing 0.01, 0.04 and 0.37%Ce, was studied in air at temperatures between 1273 and 1523K by weight-change measurements, X-ray diffraction, electron probe microanalysis and scanning electron microscopy. The surface oxide predominantly formed on all the alloys was α-Al_2O_3. The marker and kinetic studies suggested the α-Al_2O_3 scale grew into the alloys by inward diffusion of oxygen along the oxide grain boundaries. In the alloys without Ce and with 0.01% Ce, the α-Al_2O_3 scale spalled during

cooling from the oxidation temperature. Spalling of the surface oxide, probably caused by the formation of voids at the oxide-alloy interface, initially occurred at the intersection of the alloy grain boundaries, and subsequently extended to the interior of the grains. No spalling was observed on the surfaces of the alloys with 0.04 and 0.37% Ce. In both alloys, cerium primarily existed as a Ce-Fe intermetallic compound throughout the alloy matrix, which mostly precipitated at the grain boundaries. Higher cerium additions resulted in good adherence of surface oxide due to the prevention of voids formation at the oxide-alloy interface, and pegging of intergranular oxides preferentially formed at the alloy grain boundaries.