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Effects of milling time on the microstructures of sintered Fe-16Cr-4Al-0.4Y_2O_3 ODS ferritic steel

ABSTRACT. Oxide dispersion-strengthened (ODS) ferritic steels have high microstructural stability at high temperatures and provide high creep resistance as well as resistance to swelling due to neutron radiation in nuclear reactors. Mechanical alloying is normally used to manufacture the ODS alloys for nuclear reactor components. The parameters of this process influence strongly on the microstructures and properties of the materials. This paper discusses the effect of milling time on the microstructures of Fe-16Cr-4Al-0.4Y_2O_3 ODS ferritic steel. Planetary ball milling was used to prepare powder composites with milling times of 30, 60, 90 and 120 minutes. Sintering of composite green compacts was carried out at 800, 900, and 1000 °C. X-ray diffraction was used to characterize the phases formed in the ODS alloy. Analysis of microstructure, density and porosity of the sintered ODS ferritic steel was done using scanning electron microscopy and energy dispersive spectroscopy. It was found that milling for 60 minutes gave the lowest pore density in the sintered samples. A fully dissolved solid solution of α-Fe was found when the milling was carried out for at least 60 minutes.

Keywords: ferritic steels, oxide dispersion strengthening (ODS), planetary ball milling, sintering

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