ICFRM2007/461
Fabrication and characterization of ODS-steel powders by MA in H\textsubscript{2}

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Nowadays, advanced nuclear power plants (NPPs) are designed to produce more electricity with less fuel at high temperature. This requires the structural materials to possess excellent mechanical properties at high temperature and high corrosion resistance. Oxidedispersion- strengthened (ODS) steels are one of the candidates, which can withstand very high temperatures (>800°C) and severe corrosive environments.

ODS steels are always produced by mechanical alloying (MA) in an Ar atmosphere, often resulting in Ar bubbles and deteriorating the material performance. In this study, ODS-steel (Fe-16Cr-4Al-0.1Ti-0.35Y\textsubscript{2}O\textsubscript{3}) powders have been fabricated for the first time by mechanical alloying in a H\textsubscript{2} atmosphere. Eight samples were prepared at the milling times of 4, 8, 12, 24, 36, 48, 72 and 96 hours, respectively. The powders features were characterized by using Xray diffraction (XRD), scanning electron microscopy (SEM) and energy dispersion X-ray spectroscopy (EDS). It was found that the lattice constant of matrix Fe increases with milling time and approaches to a constant at 24h, indicating the end of alloying process. The mean particle size and crystallite size of MA powders decrease with milling time and reach a saturation value at 48h. The cross-section analysis of the 12 hr mechanically alloyed powders shows that all the elements distribute homogenously inside the powders. It is worth to note that the mean particle sizes of powders produced by MA in H\textsubscript{2} are about half of those produced by MA in Ar for the same duration due to interaction between metals and hydrogen. These ODS-steel powders are promising to produce high performance steels for the next generation NPPs.

Number of words in abstract: 259
Keywords:
Technical area: 31. Developing fusion materials Ferritic/martensitic and ODS steels
Special session: Not specified
Presentation: No preference
Special equipment: No special equipment