Fabrication and characterization of nano–Y_2O_3 dispersed mechanically alloyed W-Ni-Nb for high temperature applications

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Abstract. The present research work deals with fabrication of nano-Y_2O_3 dispersed tungsten (W) based alloys with nominal composition of $W_{79}Ni_{10}Nb_{10}(Y_2O_3)_1$ (alloy A), $W_{78}Ni_{10}Nb_{10}(Y_2O_3)_2$ (alloy B) and $W_{72}Ni_{10}Nb_{15}(Y_2O_3)_3$ (alloy C) (all composition in wt.%) by mechanical alloying in a planetary ball mill and compaction at 500 MPa pressure followed by sintering at 1500°C for 2 h in Ar atmosphere. The milled powders at different milling time and the consolidated products have been investigated by X-ray diffraction (XRD), scanning electron microscopy (SEM), high resolution transmission electron microscopy (HRTEM) and energy dispersive spectroscopy (EDS). Minimum crystallite size and maximum lattice strain of 20.3 nm and 0.42% respectively is achieved in alloy C. Maximum sinterability, hardness, compressive strength of 93.38%, 6 GPa, 2.5 GPa with appreciable wear resistance has been achieved in alloy C owing to the lower crystallite size, presence of higher oxide dispersion (Y_2O_3) and NbNi intermetallic. High temperature behavior of the sintered alloys is studied in a raising hearth furnace at a temperature range of 800-1000°C. The activation energy of oxidation decreases with increase in Y_2O_3 content owing to higher energy of Y_2O_3 dispersoids. Alloy A shows superior oxidation resistance at 800-1000°C as compared to rest of the alloys. The investigated alloys shows superior strength and elongation as compared to recently investigated W-Y_2O_3 alloys [1, 2].

Keywords: *W-Ni-Nb alloy, Mechanical alloying, Oxide dispersion strengthening, Hardness, Oxidation.*

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