EuroSciCon

International Conference on
Metal, Mining and Magnetic Materials

November 01-02, 2018
Paris, France

J Mat. Sci. 2018, Volume:6
DOI: 10.4172/2321-6212-C7-033

RECENT TRENDS IN DEVELOPMENT OF HIGH TEMPERATURE METALLIC MATERIALS AND PROTECTIVE COATINGS

Sanjib Majumdar
Bhabha Atomic Research Centre, India

Molybdenum and niobium based metallic materials or composites are being investigated as the potential alternative for high temperature applications beyond the capability limit of nickel based superalloys. Mo-Si-B alloy comprised with the three phase microstructure of Moss–Mo5SiB2 (T2)-Mo3Si (A15) is considered as the most promising material for these applications. The effect of rare earth elements Y and La on oxidation behaviour of Mo-Si-B alloys was studied in detail. These elements promote the formation of stable yttrium/lanthanum-molybdate phases at the early stages of oxidation. Formation and volatilization of MoO3 is suppressed and a silica-rich outer scale is formed providing superior protection against oxidation. Mo-Ti-Si alloys of compositions Mo-40Ti-30Si (in wt %) and Mo-40Ti-10Si were prepared in the form of plates by adopting mechanical alloying and subsequent reactive hot pressing at 1600 °C. The densities of the alloys were found to be much lower than the conventional alloys used for high-temperature applications. Oxidation tests of both the alloys were conducted in the temperature range 900-1300 °C in static air. Alloy Mo-40Ti-30Si showed superior oxidation resistance and the thickness of the oxide layer varied between 2-90 µm depending upon temperature and time of exposure. Mechanical properties of these alloys were compared with respect to micro or nano hardness measurements of the individual phases. Mo-TZM (Mo-0.5Ti-0.1Zr-0.02C) and Nb-1Zr-0.1C alloys were produced respectively by powder metallurgy and reduction followed by electron beam melting. Development of microstructure and evaluation of mechanical properties are studied in detail with varying heat treatment procedure. Silicide and alumino-silicide based coatings were developed on Mo-Si-B, Mo-Ti-Si, TZM and Nb-1Zr-0.1C alloys. The coated alloys showed superior oxidation resistance as compared to the bare materials. The detailed microstructural characterization using scanning electron microscopy (SEM), energy dispersive spectrometry (EDS), electron backscattered diffraction (EBSD) and transmission electron microscopic (TEM) analysis revealed the formation of different phases in the alloy systems, coating layers and protective oxide scales.

sanjib731@gmail.com