National Institute of Technology Rourkela

Departmental Seminar

Seminar Title	: Development of Mo-based alloys by conventional and pressureless sintering
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Venue	: M.Tech class room (MM 202E), MM Annex building
Date and Time	: 12 Dec 2024 (4:30 pm)
Abstract	: Mechanical alloying has emerged as a promising technique for the fabrication of Mo-Ni-based alloys, which are challenging to produce using conventional methods due to significant disparities in melting points and restricted mutual solubility. This study explores the synthesis of six unique alloy compositions through mechanical alloying: S1 (Mo80Ni10Si10), S2 (Mo80Ni10Co10), S3 (Mo80Ni10Si5Co5), S4 (Mo79Ni10Si10(Y2O3)1), S5 (Mo79Ni10Co10(Y2O3)1), and S6 (Mo79Ni10Si5Co5(Y2O3)1) (composition in weight percent). The synthesized powders were consolidated at 1500 °C in hydrogen atmosphere for 1.5 hours. Adding Ni, Si, and Co to Mo facilitated liquid phase sintering, thereby enhancing densification, while Y2O3 addition played a crucial role in grain refinement and improving mechanical properties. The introduction of Ni and Y2O3 resulted in a bimodal grain size distribution. After 20 hours of milling, oxide particles were encapsulated within the Mo particles. Studies using high-resolution transmission electron microscopy (HRTEM) and selected area diffraction (SAD) reveal the formation of nanocrystallites in oxide dispersion-strengthened (ODS) Mo alloys after 20 hours of milling. Notably, alloys with Y2O3 exhibited the minimum particle size and a bimodal distribution. X-ray diffraction (XRD) analysis of the sintered samples revealed the formation of hard and brittle intermetallic phases, such as Mo3Si (cubic), Ni3Si (cubic), and MoNi (orthorhombic), across all compositions. Elemental mapping confirmed the presence of Y2O3 oxides within the Mo matrix for alloys S4 to S6. Among the compositions, sintered alloy S6 achieved the highest relative density at 89.74%. Alloys S2 and S3 recorded the highest hardness values at 9.08 GPa and 8.85 GPa, respectively, due to the extensive formation of intermetallic phases. Mo alloys incorporated with Y2O3 particles showcased enhanced wear resistance, attributed to oxide dispersion strengthening and the presence of intermetallic phases.