National Institute of Technology Rourkela

Progress Seminar

Seminar Title	: Study of Mechanical Properties of Al-Based Hybrid Nanocomposites Reinforced with MoS2 Nanoflakes and Graphite Nanoplatelets: An Investigation of the Synergistic Effect
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Venue	: M.Tech. Class Room (Annex Building MM Department)
Date and Time	: 23 Oct 2024 (4:30 pm)
Abstract	: In the present study, Al-based hybrid nanocomposites were developed by powder metallurgy technique using binary hybrid nanofillers consisting of exfoliated MoS_2 and GnP as nanofillers. The impact of the MoS_2-GnP hybrid nanofiller on the microstructure, mechanical and tribological properties of the Al-based hybrid nanocomposites have been studied. Initially, bulk MoS_2 was exfoliated by milling in a high-energy planetary ball mill for 30 h and the GnP was synthesized by subjecting the graphite intercalation compound to a thermal shock and subsequently ultrasonicating the thermally exfoliated GnP. The effective exfoliation and structural refinement of both MoS_2 and GnP have been confirmed by X-ray diffraction and scanning electron microscopy analysis. Exfoliated MoS_2 and GnP were later blended in different ratios of their weight fraction by ultrasonication in an acetone medium. The Al matrix was then reinforced with the various binary hybrid nanofillers consisting of MoS_2 and GnP. Wear analysis revealed mechanisms such as abrasion, adhesion, ploughing, delamination, microcracks, deep grooves, and nanofiller pullout in the case of all the nanocomposites. The Al-1 wt.% $MoS_{2(0.3)}GnP_{(0.7)}$ nanocomposite shows superior properties, including the highest relative density (~93.15%), hardness (~476.28 MPa), compressive strength (~337.76 MPa) and outstanding wear resistance among all the Al-MoS_2-GnP nanocomposites. Notably, it was observed that straying from the optimal reinforcement loading level can have a detrimental effect on the physical, mechanical, and wear properties of the nanocomposites, resulting in diminished performance and reduced material integrity. The significant improvement in the wear properties of the Al-1 wt.% $MoS_{2(0.3)}GnP_{(0.7)}$ nanocomposite can be attributed to the self-lubricating properties of MoS_2 and GnP.