National Institute of Technology Rourkela

Departmental Seminar

Seminar Title	: Microstructure and Mechanical Properties of Laser Surface Melted(LSM) AISI 316L Stainless Steel
Speaker	: Prof.S.K. Karak
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Venue	: M.Tech class room (MM 202E), MM Annex building
Date and Time	: 01 Jan 2025 (10:30 AM)
Abstract	: The present study investigates the influence of laser parameters applied power density and scan speed on the microstructure and mechanical properties (microhardness and wear resistance) of AISI 316L stainless steel following laser surface melting (LSM). The LSM process was conducted using a 6.6 kW continuous-wave diode laser, with power density and scan speed ranging from 59 to 88 W/mm² and 20 to 80 mm/s, respectively. Detailed characterization included microstructure analysis, compositional evaluation, phase identification, and assessment of wear. The microstructure of the melt zone primarily consists of dendrites, with secondary arm spacing systematically varying according to the laser parameters. As the laser power density increased, lattice strain, dislocation density, and residual stress also increased, while the relationship between these properties and scan speed was inverse. The microhardness of the melt zone ranged from 181 to 337 VHN, with higher values observed at higher laser power densities or lower scan speeds. Similarly, wear volume and wear rate after LSM were found to be dependent on the laser parameters. A detailed microstructural analysis of the worn surfaces was performed to investigate the wear mechanism. Interestingly, LSM improved the corrosion resistance compared to the as-received condition, with corrosion resistance showing a systematic dependence on the LSM parameters. Electron backscattered diffraction (EBSD) analysis of the grain orientation revealed that LSM with a power density of 88 W/mm² and scan speed of 20 mm/s resulted in a lower fraction of high-angle grain boundaries and orientation mismatch.