National Institute of Technology Rourkela

Defence Seminar

Seminar Title	: Studies on Wear and Machining Performance of Particulate Filled Ramie-Epoxy Composites
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Venue	: Mechanical Engineering Dept Seminar Room (ME001)
Date and Time	: 15 Sep 2025 (12.30 PM)
Abstract	: This work aims at developing polymer composites with a less explored natural fiber (ramie) and an industrial waste (sponge iron slag) and then to compare their wear and machining performances with those of similar hybrid polymer composites with a conventional ceramic filler (titania). To attain this purpose, a series of experiments are carried out by conducting several physical, mechanical, microstructural/compositional, wear and drilling tests under controlled laboratory conditions. The findings suggest that despite being an industrial waste, the ceramic rich SI slag is a good filler material especially for polymer composites with fiber reinforcement. Apart from this, micro-sized titania is also found to be a compatible filler with ramie fiber reinforced polymer. This research shows that the physical and mechanical properties of the ramie-epoxy composites are greatly affected by the incorporation of sponge iron slag and titanium oxide. Solid particle erosion tests are carried out on the hybrid composites to explore the possibility of reinforcing hard particulate fillers to improvise the wear resistance of ramie-epoxy composites. The analysis of test results suggests that the wear resistance of ramie-epoxy composites improved with the incorporation of both SI slag and titania filler. The filler content is found to be one of the most significant control factors affecting the wear rate of the composites in erosion wear mode. Although SI slag happens to be an industrial waste, the erosion wear resistance of SI slag filled ramie-epoxy composites is fairly comparable to that of titania filled composites. The drilling characteristics of different sets of ramie-epoxy composites are carried out to explore the machinability of ramie fiber reinforced epoxy based composites. The analysis of test results suggests that the thrust force and torque measured during drilling of ramie-epoxy composites increased with filler content. However, the delamination is substantially reduced due to the incorporation of sponge iron slag and titania particles improving the machinability of the composites. Different machine learning models are implemented to predict the erosion wear rate and drilling responses of the composites under different test conditions. With fairly good mechanical properties, wear and machining characteristics, these composites have potential to be used in tribological and structural applications.