Seminar

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Institute for Plasma Research

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Title: Enhancing Material Properties through Friction Stir Processing: A Case Study on AA5083/(SiC-Gr) Hybrid Surface Composite

Speaker: Dr. Shalok Bharti
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Date: 15th March 2024 (Friday)

Time: 03:30 PM

Venue: Committee Room No. 3, IPR

Abstract

Friction Stir Processing (FSP) has become well-known for its capability to achieve superplasticity and produce surface composites, resulting in improved mechanical, microstructural, and tribological properties in different materials. FSP was developed based on the basic principle of Friction Stir Welding (FSW). Surface composites are produced by adding reinforcement particles into the base matrix. It involves using a rotating tool with a pin to cause plastic deformation and changes in the microstructure of the workpiece. This process leads to enhanced material properties and has the ability to improve features such as hardness, corrosion resistance, and tribological properties, making them useful in industries such as marine, aerospace, etc.

Aluminium alloy AA5083 are well known for their application in marine applications. Being a corrosion-resistant material, AA5083 proved its application in shipbuilding. However, this alloy lacks microhardness and wear properties. The primary objective of this study is to utilize FSP to create a surface composite on AA5083 aluminium alloy using a hybrid reinforcement of Silicon Carbide (SiC) and Graphite (Gr) to enhance microhardness and tribological properties. Through experimentation and optimization of FSP parameters, including tool rotation speed, traverse speed, reinforcement volume fraction, and particle size, optimal conditions were identified. The study revealed that a hybrid reinforcement volume fraction of 75:25 (SiC:Gr) and nanoscale particle sizes significantly improved the microhardness, wear resistance, and coefficient of friction (COF) of the AA5083 surface composite.

Furthermore, investigating FSP parameters such as tool traverse speed, rotational speed, number of passes, and alteration in tool travel direction (ATTD) revealed their significant effect on material properties. The study found that FSP process parameters, specifically three FSP passes with ATTD, led to the most advantageous results, including increased microhardness, reduced wear rate, and improved coefficient of friction (COF).

In conclusion, the research highlights the ability of FSP to create surface composites with improved properties. The development of the AA5083/(SiC-Gr) hybrid composite by FSP shows enhanced microstructural, Mechanical and tribological characteristics. These improvements are pivotal for applications in industries like marine applications, etc