INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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Programme of Study : **Ph.D.**

Thesis Title: **Mechanical, Microstructural, and Corrosion Characterizations of Similar & Dissimilar Induction Assisted Friction Stir Welding of Inconel 718 & Stainless Steel**

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SHORT ABSTRACT

Friction stir welding (FSW) of high-strength materials like Inconel 718 and steel is more challenging than welding softer materials for several reasons, including high tool degradation and the potential for defective joint formation. However, the demand for joining high-strength materials using the FSW technique is growing in industries such as nuclear plants, petrochemical, aerospace, submarine, and hydraulic power plant. This technique requires more development and improvement of the existing FSW techniques. Thus, the present study explored similar and dissimilar joining of Inconel 718 and stainless-steel materials under the conventional FSW and induction-assisted FSW process using tungsten carbide tool material. For the comparison of the conventional FSW process with external energy-assisted FSW, a setup for the induction-assisted FSW was developed, and experiments were carried out. It was found that tool life was significantly affected by the application of induction preheating. Various process parameters like weld traverse speed, tool rotational speed, plunge force, and preheating temperature affect the weld quality. From the experimental investigation of joining Inconel 718 by the FSW, it was found that an optimum traverse speed of 300 rpm and a low traverse speed of 90 mm/min resulted in refined grain microstructure, high microhardness, high strength and good corrosion resistance of the weld joint. The utilization of an induction preheating system in the FSW process resulted in improved weld quality at a high welding speed of 140 mm/min. The results also revealed that preheating affected the process temperature, lowering the axial force and frictional heat and improving the tool life.