



INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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Thesis Title: **Tool Wear and Weld Quality Characterization in Friction Stir Welding of Similar and Dissimilar Steel**

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SHORT ABSTRACT

The demand for good welding technologies and better weld quality aspects are increasing day by day with the development of advanced materials. The study of frictional stir joining of steel has attracted the attention of many researchers during the past two decades due to the wide range of advantages over the conventional fusion welding process. Despite the consequence of high process temperature and high stress on tool wear in friction welding of steel alloys, the underlying mechanisms involved in tool wear and degradation are not yet fully understood. Further, there are various weld parameters such as rotational speed, traverse speed, plunge depth, tool tilt angle that affect the final weld quality are poorly studied in the literature. Thus, the present study focusses on the effect of these important parameters on the weld quality and tool wear during friction stir welding of similar and dissimilar steel alloys. Tool offset distance and rotational speed played significant role in achieving superior mechanical properties in friction stir welding of dissimilar materials due to enhanced mechanical bonding at macroscale, and metallurgical bonding at microscale. The underlying mechanisms of heat generation, heat flow, and material flow influenced by the combined factors are also explored using computational fluid dynamics approach. This research elucidates the tool wear mechanisms for friction stir welding of steel alloys by optical and scanning electron microscopy, X-ray diffraction analysis, and surface characteristics. Furthermore, the effect of preheating on tool wear and weld quality such as tensile properties, microhardness and impact toughness in FSWed region of high strength DH36 steel are investigated.