



INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI  
SHORT ABSTRACT OF THESIS

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Programme of Study : Ph.D.

Thesis Title: **Experimental Investigation of Cusp Magnetic Field assisted GTAW of Similar and Dissimilar Low Carbon Steels and AISI 304 Stainless Steel**

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**SHORT ABSTRACT**

The research work was carried out to understand the effect of external magnetic field on the mechanical and metallurgical properties of similar and dissimilar weldments. A detailed experimental investigation on similar welding of low carbon steels and AISI 304 stainless steel plates, as well as dissimilar welding of low carbon steels and SS 304, with and without the influence of an external magnetic field were carried out. A specially designed fixture was also developed to accommodate both the permanent magnet setup and the welding torch to generate the external magnetic field. Furthermore, a 3D finite element analysis was carried out to measure the magnetic flux density along the electrode tip and compared with experimental results. With the application of external magnetic field, improvement in weld depth of penetration and reduction in bead widths were achieved. Also, a homogenous distribution of alloying elements was observed in the weld zone as compared to conventional welds. In similar welding of SS 304, due to higher arc energy densities, the thermal energies attained in CMF assisted weld pool is higher and the cooling rate is little slower resulting in favorable conditions for precipitation of austenite. Also, resulted in decrease of columnar dendrites and transformation of columnar dendrites to equiaxed dendrites in the weldment. The decrease in heat affected zone thickness was also observed in all cases. The additional magnetic field caused a stirring action in the weld pool, which enhanced grain refinement and ferrite reduction. A better corrosion rate was achieved due to homogenous distribution of alloying elements in stainless steel weldments.