INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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Programme of Study	:	Ph.D.
Thesis Title	:	**Investigation and Analysis of Micro Plasma Arc Welding of SS-316L Sheet**
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Thesis Submitted to the Department/ Center	:	Mechanical Engineerting
Date of completion of Thesis Viva-Voce Exam	:	27 September 2019
Key words for description of Thesis Work	:	Micro plasma arc welding; Weld bead geometry; Weld strength; Micro-hardness; Weld microstructure; Analysis of variance; Regression model; Outlier test; Stainless steel; Heat treatment; Thin sheet.

SHORT ABSTRACT

In the recent years automotive industry is facing a major challenge to reduce vehicles' weight for reduction of fuel consumption and carbon dioxide emission. The micro plasma arc welding is one of the key technologies in the light weight mass production of industrial products. It serves successful application in defense, medical and automobile etc. However, conventional welding like GTAW and GMAW suffers with burn through, distortion, buckling, twisting, and large heat affected zone. The micro plasma arc welding (MPAW) is an advanced technology that serves defect free joints for light weight material.

The current research work starts with design and development of suitable fixture for successful joining of thin sheet of 0.5mm, using MPAW process. A series of welding experiments were carried out with three input process parameters namely current varied in (four level), welding speed(three level) and stand of distance (three level) with application of full factorial design of experiment. The weld bead geometry and tensile properties (ultimate tensile strength, yield strength and percentage elongation), micro-hardness and grain size of HAZ are considered as weld quality characteristic parameters. Various outlier tests are applied first time in welding for detection of extreme data. The effects of heat input and process parameters on the measured weld quality parameters are studied. Analysis of variance (ANOVA) is also applied to estimate the relative importance of individual parameter and their interaction on the total variability. Finally, regression models are developed for representing the input and output relationship of the MPAW process. ANOVA is also performed to estimate the influence of factors and their interaction on the weld quality. The post welds heat treatment results in almost homogeneous microstructure and improved mechanical properties. The developed regression models discussed the correlation between the control parameters and weld qualities.

As a result it was found that tensile property like Ultimate tensile strength(UTS), % elongation, bead geometry and micro hardness models, are adequate for Heat input and effect of process parameters. Welding speed was found most influencing parameters followed by welding current and standoff distance but some property like Yield strength, Grain size, in HAZ zone, bottom width, penetration depth showing poor correlation between process parameters and output.