



**INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI  
SHORT ABSTRACT OF THESIS**

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Programme of Study : Ph.D.  
Thesis Title: Studies on Effect of Surface Profiles and Field Shaper Geometries on Electromagnetic Crimping of Tubes on Rods  
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**SHORT ABSTRACT**

The electromagnetic crimping (EMC) is a high energy, high strain rate, high velocity and green mechanical joining technique. Joining of dissimilar materials was very difficult because their physiochemical properties are seldom compatible or similar. Therefore, this type of solid-state joining technique can be an alternative for joining dissimilar materials.

Numerical studies as well as experimental work were carried out for EMC process. Numerical simulations were carried out for finding out the optimized parameters for crimping and then experiments were conducted on the optimized parameters. The results obtained from the simulations revealed that for the successful crimping minimum value of collision velocity, plastic strain, electromagnetic pressure, and stand-off distance must be maintained.

To increase the strength of the joint profiles were created on the base rod. There were three types of profiles created threaded, knurled, and plain profile. The influence of these profiles on the joint strength, surface roughness and microstructure of the joint were analyzed and compared. Mechanical tests such as compression-shear test and a pull-out test revealed that threaded surface profile on the steel rod gives better strength in comparison to the other two profiles. Along the circumference of the Copper-Steel composite rod, the microstructure images of the joints were analyzed and it was found that there was a negligible gap along the circumference of the sample crimped at 5.3 kJ of discharge energy with a plain profile. This study has been carried out with two different combinations of materials such as aluminum-steel and Copper-Steel. For the Copper-Steel combination of materials, tapered field shaper was used whereas for aluminum-steel combination of materials stepped field shaper was used.

Further, to compare to the performance of the field shaper. A comparative experimental as well as a numerical study has been carried out for three different types of field shapers namely tapered, step-tapered and stepped field shapers. In this comparison the material combination used was Copper-

Aluminum. From the study it can be concluded that the step-tapered field shaper results better in terms of uniformity in crimp quality, joint strength in compression, joint strength in tension, joint electrical resistance, joint leakage and surface finish of the crimped sample among the three types of field shaper.

The comparative study of the three types of field shaper was further extended to measure the temperature generation near the working zone. The measured temperature distribution in the experiments were compared with the temperature distribution obtained from the numerical study. The numerical results were validated with the experimental results with respect to the temperature distribution and with the measured crimped sample diameter.

