

# Seminar

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## Institute for Plasma Research

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**Title :** Electro Magnetic Pulse Welding of Similar and Dissimilar Materials and Characterization of Weld Joint

**Speaker:** Mr. Bharat Doshi  
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**Date :** 8th March 2019 (Friday)

**Time :** 10:30 AM

**Venue :** Committee Room 4, (New Building), IPR

### **Abstract :**

Electro-Magnetic Pulse Welding (EMPW) is a solid state welding process carried out at nearly room temperature, in which joining is occurred by transformation of electrical energy to mechanical energy resulting into high impact velocity deformation. It is an efficient and environmentally friendly welding technique used to weld multi materials. As the electrically conductive (tube) part is positioned in the bore of EM coil, an opposing eddy current is induced in the tube. Consequently, high Lorentz forces act on the tube, leading to acceleration away from the EM coil. In case of a tube, it gets compressed under impact velocity of few hundred meters per second and collides with the second metallic joining rod which is rigidly held in position, thus resulting into formation of a jet under appropriate collision conditions. Due to the high pressure impact, metallurgical bonding takes place. The sound weld joint has a characteristic feature of the wavy interface resulting from the heavy plastic deformations. In the present work, the necessity of dissimilar material joints in high technology Industrial applications and challenges in joining the dissimilar materials is reported. Solid state welding such as Electro-Magnetic Pulse Welding (EMPW) technique along with experimental set up is explained and is employed for joining of various similar and dissimilar materials (combinations of Stainless Steel, Copper, and Aluminum) using tubular work pieces to attain the lap joints. The process, parameters like current, voltage, inductance, coil dimensions, work piece dimensions, air gap, impact velocity, effective plastic strain, shear stress acting in the welding zone/impact zone etc. are studied. Experiments on welding of the different alloy tubes to similar/dissimilar materials have been performed. The Electromagnetic coil of single turn (S.S.304) with field shaper (copper) and EM coil fully made of copper has been designed and manufactured. The single turn coil is integrated with EMPW experimental setup. Experiment and investigation on welding of the different alloy tubes to similar/dissimilar materials have been performed. The experiments are performed at tens of kV, charged into 64 $\mu$ F (320 $\mu$ F) capacitors bank system and the stored energy is discharged into single turn EM coil. The weld joints are performed on tubular/rod structure of more than 20 samples of different sizes, different similar and dissimilar material combinations using EMPW techniques. The weld joints are evaluated and characterized using destructive and non-destructive testing methods. In this talk EM coil design and manufacturing, experimental results and characterization and testing of the samples will be discussed.

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