Seminar

Institute for Plasma Research

Title : Developments of friction stir welding process for dissimilar copper - stainless steel Joints

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Date : 29th October 2020 (Thursday)

Time : 3.30 PM

Venue : Online - Join the talk:
https://meet.ipr.res.in/Dr.GaurangJoshi_PDFtalk

Abstract :

The amalgamation of diversified properties of Cu and SS in single structural component can serve the techno-economic aspect of the modern industries. Therefore, dissimilar material is a recent attraction and focus for industry and academia. However, the diversified thermal conductivity, melting ranges and mechanical properties are major associated problems which needs to be addressed to join Cu/SS. In order to overcome above stated difficulties, a unique up gradation of solid state joining process is exploited i.e. friction stir welding. The effect of tool pin shoulder diameter is investigated initially by keeping other process parameter constant. The optimum condition achieved is employed to establish the effect of preheating by gas tungsten arc welding torch and post cooling by compressed air and water. Besides, the Cu/SS bimetallic joint further obtained by gas tungsten arc welding at different current levels (125A, 150A and 200A) and laser beam welding by varying laser beam position in order to compare the results of friction stir welded joints. The joint integrity of the welds produced are assessed on the scale of visual inspection and macrostructure initially. Subsequently, the joints are analyzed by its microstructural features, tensile properties, fracture surface, hardness profile, scanning electron microscopy, electron dispersive spectrographs and X-ray diffraction characterizations. The better joint strength of 174 MPa is obtained at 18 mm shoulder diameter. Wherein, major defects are observed at rest of the friction stir welding conditions. The defects are attributed to suspended SS particle within Cu metal matrix and it concentrated at or around it leading to poor weld quality. On the other hand, exploited gas tungsten arc and laser beam welding conditions found suitable for sound joints. No doubt that shifting laser beam towards SS side causing solidification cracking. Furthermore, the phases of intermetallic compounds such as chromium iron nickel carbon, carbon chromium iron and copper nickel are reported in the weld area by friction stir welding i.e. one of the reason of hardness fluctuations. Besides, gas tungsten arc welding and laser beam welding of Cu/SS are reported maximum tensile strength of 179 MPa and 224 MPa. However, the present results of mechanical and metallurgical amalgamation by means of friction stir welding is well above the acceptance level. Wherein, joint consolidation while friction stir welding is comparable with those of gas tungsten arc and laser beam welding