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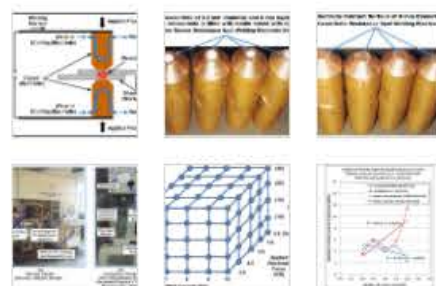
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Characteristics of Resistance Spot Welding using Annular Recess Electrodes

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Abstract

Resistance spot welding is widely used in manufacturing industries, such as automobile structural body manufacture, rail vehicle construction, electronics manufacture, battery manufacture, etc. Resistance spot weld integrity is of paramount importance in the manufacturing industry, especially in automotive body joining to ensure that the automobile bodies can withstand the stress levels that the vehicle is subjected in operation. A number of factors - including electrode geometry, electrode force, welding current and welding time - influence the quality of the resistance spot weld. The electrode material that ensures electrical conductivity and compressive strength and electrode geometry defined by the electrode tip profile, shape, size are important factors in resistance spot welding. This paper discusses the comparative performance of resistance spot welding electrodes with annular recess design and the conventional solid design in welding of a 1mm thick steel sheet used in construction of automobile structural bodies. The copper-based electrodes used in this study were prepared as described in the ISO 5182:2008 Standard. The annular recess electrode was designed using SolidWorks Version 2015; a hole measuring 4 mm deep and 2.50 mm in diameter was created centrally on the electrode tip and filled with heat resistant mixture of cement and kaolin ceramics. The effects of applied electrode force, current, and weld time on weld-integrity were investigated for the two designs of resistance spot welding electrodes. Linear regression analysis of data obtained established that the weld strength and nugget diameter was higher for the annular recess electrode than the conventional solid electrode. An analysis of variance established that the observed variation of the nugget diameter with weld time was statistically significant but the variations of weld strength with applied electrode force and variation of nugget diameter with current were not statistically significant which may require further study.

Keywords

Resistance Spot Welding; Annular Recess Electrode; Conventional Solid Electrode; Welding Current; Nugget diameter; Weld-integrity

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