

Process Parameter Study on Friction Push Plug Welding of AA6061 Alloy

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Abstract : Friction Push Plug Welding (FPPW) is a solid phase welding suitable for repairing defective welds and filling self-reacting weld keyholes in Friction Stir Welds. In FPPW process, a tapered shaped plug is rotated at high speed and forced into a tapered hole in the substrate. The plug and substrate metal is softened by the increasing temperature generated by friction and material plastic deformation. This paper aims to investigate the effect of process parameters on the quality of the weld. Orthogonal design methods were employed to reduce the amount of experiment. Three values were selected for each process parameter, rotation speed (1500r/min, 2000r/min, 2500r/min), plunge depth (2mm, 3mm, 4mm) and plunge speed (60mm/min, 90mm/min, 120r/min). AA6061aluminum alloy plug and substrate plate was used in the experiment. In a trial test with the plunge depth of 1mm, a noticeable defect appeared due to the short plunge time and insufficient temperature. From the recorded temperature profiles, it was found that the peak temperature increased with the increase of the rotation speed, plunge speed and plunge depth. In the initial stage, the plunge speed was the main factor affecting heat generation, while in the steady state welding stage, the rotation speed played a more important role. The FPPW weld defect includes flash and incomplete penetration in the upper, middle and bottom interface with the substrate. To obtain defect free weld, the higher rotation speed and proper plunge depth were recommended.

Keywords : friction push plug welding, process parameter, weld defect, orthogonal design

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