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Abstract

Resistance spot welding of aluminum alloys is increasingly used in the automotive industry for vehicle lightweighting and better fuel efficiency. In this contribution, General Motor's aluminum spot welding process including Multi-Ring Domed (MRD) electrodes and Conditioning, Shaping, and Sizing (CSS) weld schedule were used for welding of 0.8-mm thick X626-T4 aluminum alloy sheet. The resultant spot welds had an equiaxed grain structure adjacent to the weld nugget periphery. Within the weld nugget, fine columnar grains were found at the nugget perimeter, while welding defects were concentrated in the centre of the nugget. Using modified shear specimens, it was determined that the weld nugget is the weakest location while the heat affected zone is enhanced by precipitation aging due to a combination of welding and paint bake thermal cycles. We then derived a new equation for calculating minimum weld nugget diameters to ensure that interfacial fracture would not occur during tensile and fatigue testing. Load controlled fatigue test results showed that using structural stress