Accepted Manuscript

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PII: S0142-1123(18)30227-5
DOI: https://doi.org/10.1016/j.ijfatigue.2018.06.009
Reference: JIJF 4713

To appear in: *International Journal of Fatigue*

Received Date: 1 December 2017
Revised Date: 1 June 2018
Accepted Date: 6 June 2018

Please cite this article as: Rao, H.M., Kang, J., Shi, L., Sigler, D.R., Carlson, B.E., Effect of Specimen Configuration on Fatigue Properties of Dissimilar Aluminum to Steel Resistance Spot Welds, *International Journal of Fatigue* (2018), doi: https://doi.org/10.1016/j.ijfatigue.2018.06.009

Effect of Specimen Configuration on Fatigue Properties of Dissimilar Aluminum to Steel Resistance Spot Welds

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Abstract

General Motors (GM) has developed a proprietary resistance spot welding process using a Multi-Ring, Domed (MRD) electrode geometry that is capable of producing welds between aluminum alloys and steel materials with acceptable joint strength. This work presents fatigue properties of resistance spot welds (RSWs) produced between dissimilar 1.2-mm thick wrought aluminum AA6022-T4 and 2.0-mm thick IF steel RSWs in tensile-shear and coach-peel configurations. The results were compared to those of spot welds made of 1.2-mm thick and 2.00-mm thick AA6022-T4. The tensile-shear and coach-peel spot welds exhibited limited scatter in fatigue life for both stack-ups. The overall fatigue life of the tensile-shear AA6022-T4 to IF stack-ups was much greater than that of the AA6022-T4 to AA6022-T4 stack-ups. However, in coach-peel, there was no significant difference in fatigue life between the two stack-ups. In both tensile-shear and coach-peel fatigue tests the fracture mode for both stack-ups was primarily crack growth through the 1.2-mm thick AA6022-T4 sheet. The superior performance of the tensile-shear AA6022-T4 to IF steel RSWs was most likely a result of larger weld nugget size along with microstructural features that improved performance. These included more favourable notch root openings as well