Researchers improve mechanical properties of aluminum/steel joints

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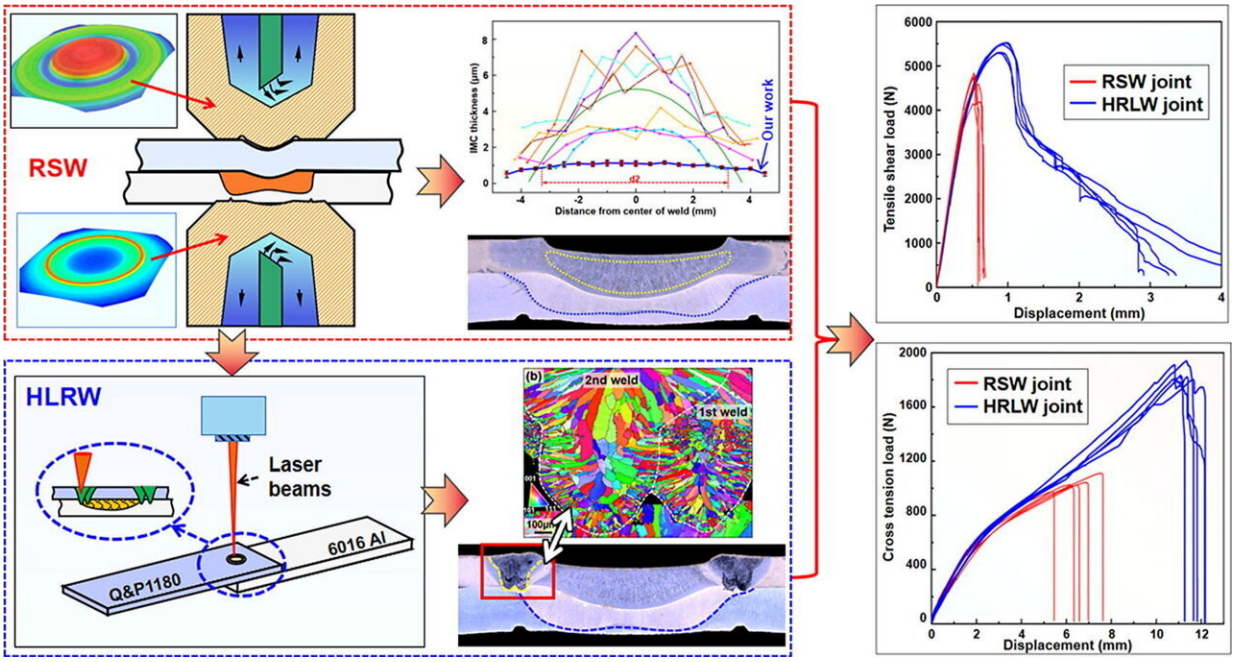

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Researchers from Shanghai Institute of Optics and Fine Mechanics (SIOM) of the Chinese Academy of Sciences (CAS) carried out experimental research on resistance-laser spot welding technology for aluminum/steel dissimilar metals, and made improvement in the mechanical properties of aluminum/steel welding joints. The study was published in *Materials & Design.*

To improve the poor performance of aluminum/steel dissimilar metal welds, the researchers used a resistance-laser spot welding technique to weld the combination. The spot welds are made by resistance spot welding connection technology, which is the mainstream technology in automobile manufacturing, and circular welds are made around the spot welds by laser flight welding technology.

The researchers found that significant improvements in the mechanical properties of aluminum/steel joints were achieved by changing the joint structure and controlling the thickness of brittle intermetallic compounds. The resistance spot weld had a considerable tensile-shear load but poor ductility and energy absorption due to the presence of a weak bonding area around the periphery of the joint, which facilitated the crack initiation and rapid propagation. The following laser spot welding process was conducted in the weak bonding area of the resistance spot welding joint, which inhibited rapid propagation of the cracks along the faying interface avoiding the interface fracture.

Aluminum/steel dissimilar metal welding technology has broad application prospects in the context of automotive light-weighting. However, due to the huge difference in thermophysical properties between aluminum/steel, a large amount of brittle intermetallic compounds and cracks are formed in the weld after welding, resulting in the situation that the aluminum/steel joints cannot meet the body application requirements.

So far, many published works mainly focus on the optimization of welding parameters and tailoring of alloying elements in welds, aiming at reducing the formation of brittle intermetallic compounds in the weld and improving the mechanical properties of the joint. This work provides a new technical solution for aluminum/steel dissimilar metal welding.

More information: Mingfeng Li et al, Hybrid resistance-laser spot welding of aluminum to steel dissimilar materials: Microstructure and mechanical properties, *Materials & Design* (2022). DOI: 10.1016/j.matdes.2022.111022

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