RSR
MULTI-MATERIAL JOINING
PATENTED

RESISTANCE SPOT RIVETING

MIXED MATERIAL JOINING FOR NEXT GENERATION STRUCTURES

Deploying RSR with Composites – 2026 Q2 Edition

Advances in composite chemistry and manufacturing have enabled adoption beyond niche applications into structural vehicle systems. Carbon-fiber Reinforced Polymers (CFRP), Glass-fiber Reinforced polymers (GFRP's), and Sheet Molding Compounds (SMC) use continues to increase and can be found everywhere from front-end modules to battery enclosures. While adoption has steadily increased, it is not without barriers such as manufacturing speed, recycling and joinability. Assembly solutions remain limited when using composites, especially when joining to high strength materials. This prompted OEM's to connect and served as the basis for RSR research. Figure 1 shows a composite joint largely unsolved by existing technologies.

Composites exhibit unique process-sensitive behavior resulting in poor joint performance when attempting to use conventional joining methods. Many composites exhibit poor thermal conductivity increasing sensitivity to heat which results in matrix degradation and often fail through delamination or fiber fracture rather than metallic ductile deformation. Joining behavior is highly material dependent - meaning what works for a CFRP material may be unsuitable for a GFRP.

Figure 1 – Cross section of 1.6 mm CFRP joined to 1.5mm Usibor1500 using RSR

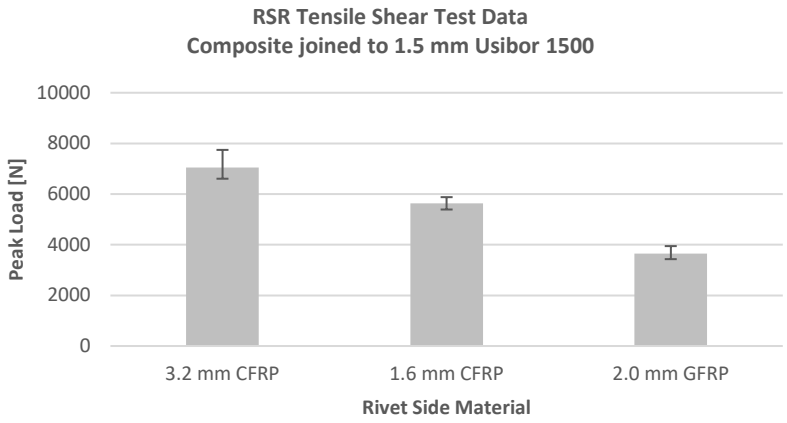

Figure 2 – Tensile Shear Performance of Composite-to-Steel RSR Joints

When joining composites with RSR, a pilot hole is placed in the composite which allows the rivet to contact the steel or aluminum sheet. The rivet expands when current is applied to fill the hole while forming a metallic weld to the underlying metal. The rivet undergoes controlled expansion to fill the hole while a metallic weld is formed between the rivet and the metallic sheet.

The RSR team has begun exploring composite-specific challenges. Properties including electrical conductivity, thermal conductivity and stiffness all influence the joining process. Welding techniques have been adapted to improve process stability.

Introductory mechanical testing has been conducted on multiple composites to assess the mechanical performance in tensile shear mode. The peak load is plotted in Figure 2. Initial results show encouraging and consistent test data across multiple composites joined with RSR. Failure modes were primarily in the composite materials during testing – Figure 3.

Research is ongoing to refine welding methods, improve robustness and develop a flexible production-ready joining process for a broad range of composite materials.

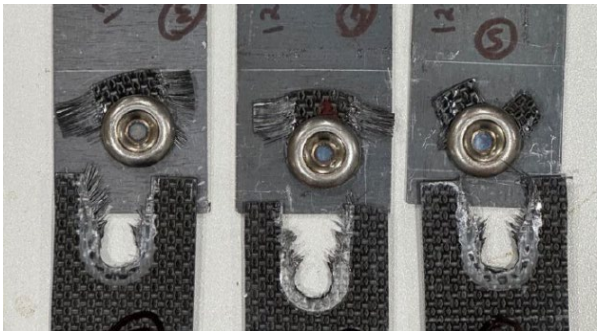

Figure 3 – Tensile Tested RSR Samples Joining 1.6 mm

Want to learn more about this topic or RSR? Have feedback on the topic? Do you have a topic or development request for us?

Please reach out to your RSR representative. We would be happy to meet and discuss solutions for all your joining challenges!

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