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## Lightweight and anti-corrosive fiber reinforced thermoplastic rivet

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### ABSTRACT

A lightweight anti-corrosive rivet is proposed using a fiber reinforced thermoplastic (FRTP) for the joining of carbon fiber reinforced plastic (CFRP). The FRTP rivet was fabricated via the braiding technique, where Glass fiber/PA66 commingled yarns were wrapped around straightly aligned Carbon fiber/PA66 commingled yarns. Using a pultrusion method, the braided yarn was consolidated into a FRTP rod, which was then cut to an appropriate length for use as a FRTP rivet. Quasi-isotropic CFRP laminates were joined by this rivet through a thermal forming process. Single-lap joint specimens were subjected to tensile tests, and compared with a bolted and blind-riveted joint. The joint strength increased with increasing fiber volume fraction of the FRTP rivet, which had a higher specific joint strength than the other metallic joints. The results revealed that, for the same joint strength, FRTP-rivet replacement of the metallic joint yields a reduction in the weight of the joint.

**Keywords:** Joint, Fastener, Rivet, Adhesive, Polymer matrix composites, Thermoplastic

### 1. Introduction

A mechanical fastener, such as a rivet, is widely used in conjunction with adhesive bonding for the joining of carbon fiber reinforced plastic (CFRP) laminates. An adhesive joint bears the operational load or shear load while a mechanical joint bears large loads or prevents peeling and serves as a substitute for adhesive debonding. In addition, an adhesive joint is sensitive to environmental factors, such as the humidity and temperature. Weak or kissing bonds occur occasionally in an adhesive joint [1-3] and therefore, hybrid joints of mechanically fastened and adhesively bonded joints yield increased structural reliability [4-6].

Mechanical fasteners for CFRP laminates are generally composed of metallic materials, such as aluminum alloy or titanium alloy, with higher densities than that of CFRP. Material joining is critical for achieving large structures, but the structural weight increases with increasing number of fasteners. Furthermore, metallic

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