Fabrication of the carbon fiber reinforced plastic (CFRP) cone tube through the laboratory-scale 3-axis winding machine

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ABSTRACT

Filament winding process is one of the composite fabrication methods, which has relative lower manufacturing costs, higher efficiency and automation. It is commonly used to manufacture axisymmetric composite products, such as tubes, vessels, and domes, which is mainly used in aerospace, military and defense technology. However, it is a challenging task to fabricate a composite cone structure with the high winding angle through a laboratory-scale 3-axis winding machine. This paper aims to design and fabricate the carbon fiber reinforced plastic (CFRP) cone tube by using a low-cost filament winding machine. The cone mandrel was designed and prepared using additive printing technique. Dry and wet winding processes were conducted with yarn and 3K carbon fiber tow, respectively. The CFRP cone tube was successfully designed and fabricated with a winding angle of 75.11°±0.12°. It can be concluded that the wet winding process provides better winding quality and higher surface smoothness compared to the dry winding process. Moreover, the compressive modulus was 1.62 GPa, and the maximum compressive stress was 16.29MPa under quasi-static compression loading.

KEYWORDS

CFRP; Cone tube; Dry winding; Filament winding technique; Quasi-static loading; Thin-walled structure

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