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Failure Analysis of $(\pm 55)_4$ Basalt/Epoxy Composite Pipes with a Surface Crack under Tensile Force

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Abstract

Basalt fiber-reinforced polymer composites are a good alternative to glass and carbon fiber-reinforced composites in the industry for polymer composites used in aerospace, marine, and automotive. The aim of this study was to investigate failure analysis of filament wound basalt-reinforced plastic (BFR) composite pipes made of Basalt/epoxy with a surface crack under tensile force. The BFR composite pipes were produced of four antisymmetric layers with $(\pm 55°)_4$ winding angles employing the filament wound method. Split-disk tests (according to ASTM D-2290 standard) were performed at a 0° crack angle and the crack-to-thickness ratio of a/t= 0.25, a/t= 0.50, and a/t= 0.75. It was determined that the surface crack of 0° parallel to the axis of the composite pipe reduces the strength of the pipe, and also the strength considerably decreases with the increase of the crack depth. The hoop strengths of BFRP composite pipes that have surface cracks were determined, and the dependence of the hoop strength on the crack-to-thickness ratio was discussed in detail.

Keywords: Basalt fiber, Damage, Hoop strength, Split-desk method, Semi-elliptical crack