

An Experimental Investigation on Mechanical Behaviour of Fiber Reinforced Polymer (FRP) Composite Laminates Used for Pipe Applications

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Abstract : In this experimental work, fiber reinforced polymer (FRP) composite laminates were manufactured using hand lay-up technique. The unsaturated polyester (UP) and vinylester (VE) were considered as resins reinforced with different woven fabrics (bidirectional and quadriaxial rovings). The mechanical behaviour of the resulting composites was studied and then compared. A focus was essentially done on the evaluation of the effect of E-Glass fiber and ply orientation on the mechanical properties such as tensile strength, flexural strength, and hardness of the studied composite laminates. Also, crack paths and fracture surfaces were examined, and failure mechanisms were analyzed. From the main results, it was found that the quadriaxial composite laminates (QA/VE and QA/UP) with stacking sequences of $[0^\circ, +45^\circ, 90^\circ, -45^\circ]$ present a very ductile tensile behaviour. The other laminate samples (R500/VE, RM/VE, R500/UP and RM/UP) show a very brittle behaviour whatever the used resin. The intrinsic toughness KIC of QA/VE laminate, obtained in fracture tests, are found more important than that of RM/VE composite. Thus, the QA/VE samples, as multidirectional laminate, presents the highest interlaminar fracture resistance.

Keywords : crack growth, fiber orientation, fracture behavior, e-glass fiber fabric, laminate composite, mechanical behavior

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