

Effects of hydrothermal ageing on the behaviour of composite tubes under multiaxial stress ratios

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Abstract

The effects of accelerated hydrothermal ageing on the behaviour of composite tubes under multiaxial stress were experimentally investigated. A set of $[\pm 55^\circ]_4$ tubes were hydrothermally aged at 80 °C for 1500 h. An indigenous automated test rig was fabricated to accommodate five stress ratios—0H:1A, 1H:1A, 2H:1A, 4H:1A, and 1H:0A. The cyclic test involved, pressurising the tube with 1-min pressure and 1-min no-pressure cycles. The first ply failure points were determined from the axial and hoop stresses. Failure envelopes were constructed at the aforesaid five stress ratios. Fourier transform infrared results show an increase in the intensity of absorbance peaks of the OH stretching bands at the interphase. The scanning electron microscopy micrographs of aged samples show clear debonding between the epoxy resin and the glass fibres, which is a cause of failure. Moisture uptake by the epoxy leads to matrix osmotic cracking, resulting in damage.

keywords

Glass reinforced epoxy composite pipes, Hydrothermal ageing, Multiaxial cyclic, loading First ply failure, Moisture