

Effects of winding angles in biaxial ultimate elastic wall stress (UEWS) tests of glass fibre reinforced epoxy (GRE) composite pipes

Abstract

This paper presents an experimental investigation into the influence of winding angles in multi-axial ultimate elastic wall stress (UEWS) tests of glass-fibre reinforced epoxy (GRE) composite pipes. Currently, UEWS test is one of the alternative methods used to the 1000-hour test procedure detailed in ASTM D2992 for the detection of manufacturing changes and reconfirmation of the design basis of composite pipes. A stress-strain response was obtained for each winding angle and the results then compared with those computed through conventional laminate theory. Experimental data showed that the UEWS point varies for each winding angle, and the difference becomes even more pronounced, especially when the angles deviated from the ideal $\pm 55^\circ$. It is also concluded that the UEWS stresses, which represent the onset of non-linearity were very much dependent on the transverse and shear stress responses, and these values were found to be consistent with the predicted values from the commonly used Tsai Wu failure criterion.

Keywords

Biaxial loading; Filament winding; Glass fibre reinforced epoxy pipes; Ultimate elastic wall stress (UEWS); Winding angles