

General lifetime damage model for glass fibre reinforced epoxy (GRE) composite pipes under multiaxial loading

Abstract

This paper presents the modelling of a general lifetime performance for glass fibre reinforced epoxy (GRE) composite pipes similar to the well-known Tsai-Hill interactive failure criterion. Tsai Hill criterion is based on the Von Misses distortional energy criterion which was modified to satisfy the orthotropic nature of GRE composite pipes. The effects of stress developed in each ply from ultimate elastic wall stress (UEWS) test were expressed in a single quadratic term of axial and hoop stress through laminate theory. The term then solved to produce limits with respect to axial and hoop stress, which represented in a graphical form of failure envelope. The modelled envelop shows a good agreement with experimental data from the multiaxial UEWS test of $\pm 55^\circ$ GRE composite pipes. This indicates that such model can be used to predict the long-term performance of GRE pipes under combine loadings.

Keywords — Filament winding, biaxial loading, composite pipes, glass fibre reinforced epoxy, ultimate elastic wall stress (UEWS).