

## **Acoustic emission monitoring of multiaxial ultimate elastic wall stress tests of glass fibre-reinforced epoxy composite pipes**

### **Abstract**

This paper describes the acoustic emission (AE) monitoring of multiaxial ultimate elastic wall stress (UEWS) tests of filament wound glass fibre-reinforced epoxy composite pipes under hydrostatic, pure axial and pure hoop loadings at room temperature. The purpose of AE monitoring is to quantitatively identify and characterise damage inception and evolution, which leading to different failure mechanisms via an analysis of AE parameters. AE parameters such as counts and energy released were plotted against time, and changes of these AE activities were monitored. A 3D correlation plot between AE amplitude and duration against time for each loading condition was produced and analysed. The AE measurement of both hydrostatic and pure axial loading suggested that matrix cracks were initiated early in the tests and possible had progressed into delamination failure just before UEWS point was reached at 200 MPa of hoop stress and 63 MPa of axial stress, respectively. No clear damage initiation and progression was observed for pure hoop loading condition. Significant AE events were only noted when buckling induced delamination and debonding failure, which followed by fibre fracture at the outer surface of the pipe.

Keywords; Polymer-matrix composites (PMCs), Strength, Acoustic emission, Filament winding, Matrix cracking, Ultimate elastic wall stress (UEWS)