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Acoustic emission of material damages in glass fibre-reinforced plastics

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Abstract

The aim of this study is to compare two different standardized testing procedures, tensile testing and Mode-I double cantilever beam (DCB) testing, to evaluate a possible correlation between the dominant failure in glass fibre-reinforced plastics and their according acoustic emissions (AE). AE is processed by using a burst collection of all recorded transient signals and is further analysed with the k-means clustering algorithm. To generate damage related AE, a series of experiments for tensile testing and Mode-I DCB testing is performed on 16-layer glass fibre/epoxy specimens with a cross-ply lay-up for tensile and an unidirectional lay-up for Mode-I DCB testing. Three sensors at tensile testing and one sensor at Mode-I DCB testing gather AE data. The results of clustered burst signals show a good accordance between both testing procedures, with a similar weighted peak frequency (WPF) range in each classified cluster. In total, three different clusters are determined. An assignment of these three clusters to the three dominant damage mechanisms, visually observed by microscopy, is suggested.

Keywords: A. Glass fibres, A. Thermosetting resin, D. Acoustic emission, D. Mechanical testing

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