

Notch-based strategy for improving failure mode differentiation in CFRP specimens using acoustic emission signals

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In this paper we introduce a novel method to distinguish fibre failure from other failure modes in CFRP specimens based on their acoustic emission signals. Extending previous studies, we performed a tensile test and recorded the acoustic signals during the test with 4 piezo sensors. The specimen geometries were made of CYCOM 977-2 (Solvay) prepreg consisting of 6 layers [90/90/0/0/90/90] and cut according to DIN EN ISO 527-4. In addition, half of the specimens were notched in the centre by cutting all outer 90° preforms on both sides and then separated in our developed tool. The objective is to create a semi-circular notch to reduce the unwanted stress increase in the notch area. The remaining half of the specimens without a notch were used as a reference. Multiple failure modes such as matrix fracture, fibre fracture and various delamination modes were induced during the tensile test. We aim to reduce the typical failure modes in the outer layers through the notch. This will increase the proportion of fibre break failure modes in the specimen and thus increase the contrast after data processing. We compared the results of the two types of specimens mainly based on cluster analysis. We used typical features such as weighted peak frequency, partial power 2 and maximum amplitude for clustering. The analysis of the qualitative and quantitative results supports the proposed methodology and confirms our expectations.