Analysis of Behavior of Fiber Composite During Loading Tests

Vladimír Mára[1], Jan Krčil[1], and Miroslav Černý[2]

[1]*Czech Technical University in Prague, Department of Materials Engineering, Karlovo náměstí 13, 12135, Prague 2, Czech Republic*
[2]*Czech Technical University in Prague, Department of Structural Mechanics, Centre of Composites, Solinova 7, 166 08 Prague 6, Czech Republic*

Acoustic emission is a physical phenomenon at which arises release of energy due to the stimulation by external or internal stress. The defects present in the material act as AE source that generates elastic stress waves. Propagating waves can be detected on the materials surface by mounted piezoelectric sensors and recorded as waveform. Formation or spread of damage processes can be determined by analyzing either the waveform or its parameters. Operating conditions (fatigue, impact, static overload) can lead to reduction of materials properties and collapse of the structure. Since acoustic emission is a non-destructive method it can be used to monitor the condition of components and thus prevent its catastrophic failure.

The unidirectional glass fiber reinforced polymer matrix composite (GFRP) was inspected with usage of acoustic emission during the static loading tests. For better detection and identification of damage processes 90° and 0° orientation testing specimens were manufactured and for each type of orientation tensile and three-point bend test was performed.

The data obtained from mechanical testing were correlated with selected acoustic emission parameters and based on the results the damage mechanisms were determined and for that purpose, the absolute energy, counts, events and peak frequency were chosen. Further investigation was done by converting the time domain of waveform recorded in different location to frequency by a Short-time Fourier transform (ST-FFT). Failure mechanisms were inspected by light microscopy and for more detailed analysis the scanning electron microscopy (SEM) was used.

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