Thermal diffusivity measurements of porous CFRP specimens with different number of plies using pulsed thermography in transmission and reflection mode

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Abstract

Porosity in carbon fibre reinforced polymers (CFRP) degrades the engineering performance, especially the interlaminar shear strength. In this work the porosity of CFRP was successfully determined by means of pulsed thermography. Additionally cone beam Xray computed tomography (3D-XCT) measurements were carried out. The observation time and the resulting thermal diffusivity were determined for 116 CFRP test specimens with different porosity levels and different numbers of plies. The samples were fabricated using 5 ply, 10 ply and 20 ply laminates, and the specimen thicknesses varied from 1.02 mm to 5.2 mm. The comparison of CFRP specimens with different numbers of plies shows similar results in the dependency of thermal diffusivity on porosity. The results show a very good correlation between transmission and reflection measurement methods. The good correlation between the effective medium theory and the experimental results allows a quantitative evaluation of porosity with pulsed thermography to be made, which yields results comparable to the quality of ultrasonic testing.

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