

The Influence of Fiber Volume Fraction on Thermal Conductivity of Pultruded Profile

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Abstract : Thermal conductivity in the x, y and z-directions was measured on a pultruded profile that was manufactured by the technology of pulling from glass fibers and a polyester matrix. The results of measurements of thermal conductivity showed considerable variability in different directions. The caused variability in thermal conductivity was expected due fraction variations. The cross-section of the pultruded profile was scanned. An image analysis illustrated an uneven distribution of the fibers and the matrix in the cross-section. The distribution of these inequalities was processed into a Voronoi diagram in the observed area of the pultruded profile cross-section. In order to verify whether the variation of the fiber volume fraction in the pultruded profile can affect its thermal conductivity, the numerical simulations in the ANSYS Fluent were performed. The simulation was based on the geometry reconstructed from image analysis. The aim is to quantify thermal conductivity numerically. Above all, images with different volume fractions were chosen. The results of the measured thermal conductivity were compared with the calculated thermal conductivity. The evaluated data proved a strong correlation between volume fraction and thermal conductivity of the pultruded profile. Based on presented results, a modification of production technology may be proposed.

Keywords : pultrusion profile, volume fraction, thermal conductivity, numerical simulation

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