

Nano-Filled Matrix Reinforced by Woven Carbon Fibers Used as a Sensor

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Abstract : Improving the electrical properties of organic matrix composites has been investigated in several studies. Thus, to extend the use of composites in more varied application, one of the actual barrier is their poor electrical conductivities. In the case of carbon fiber composites, organic matrix are in charge of the insulating properties of the resulting composite. However, studying the properties of continuous carbon fiber nano-filled composites is less investigated. This work tends to characterize the effect of carbon black nano-fillers on the properties of the woven carbon fiber composites. First of all, SEM observations were performed to localize the nano-particles. It showed that particles penetrated on the fiber zone (figure1). In fact, by reaching the fiber zone, the carbon black nano-fillers created network connectivity between fibers which means an easy pathway for the current. It explains the noticed improvement of the electrical conductivity of the composites by adding carbon black. This test was performed with the four points electrical circuit. It shows that electrical conductivity of 'neat' matrix composite passed from 80S/cm to 150S/cm by adding 9wt% of carbon black and to 250S/cm by adding 17wt% of the same nano-filler. Thanks to these results, the use of this composite as a strain gauge might be possible. By the way, the study of the influence of a mechanical excitation (flexion, tensile) on the electrical properties of the composite by recording the variance of an electrical current passing through the material during the mechanical testing is possible. Three different configuration were performed depending on the rate of carbon black used as nano-filler. These investigation could lead to develop an auto-instrumented material.

Keywords : carbon fibers composites, nano-fillers, strain-sensors, auto-instrumented

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