

Influence of the Wear of Carbon Nanotubes Grafted on Carbon Fibers

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Carbon nanotubes (CNTs) are grafted on the surface of carbon surface to reinforce mechanical properties of composite. During industrial process, the CNTs grafted fabric will be guided with cylindrical systems. This will cause friction stresses and wear on the fabric. The aim of this study is to highlight the wear mechanism of the CNTs due to friction stresses, to analyze this behavior in order to determine their influence on the composite processing.

Multi-walled carbon nanotubes are directly produced on the carbon textile by the flame method using a metallic catalyst [1-2]. The catalyst used influences the CNTs length and diameter, therefore the quality of the CNTs (number of defect).

In order to wear the CNTs, friction tests are processed on a linear reciprocating tribometer, with a cylindrical slider to approach a rolling on a metallic piece [3]. The normal load is of 1N, at a sliding velocity of 20 mm/s and a sliding distance of 20 mm. The wear mechanism of CNTs was highlighted by SEM observation. At first, CNTs are entangled on the surface (a). As soon as the friction starts, CNTs are aligned in the friction direction (b) and then are crushed and formed a transfer film (c), around 10 cycles of friction.

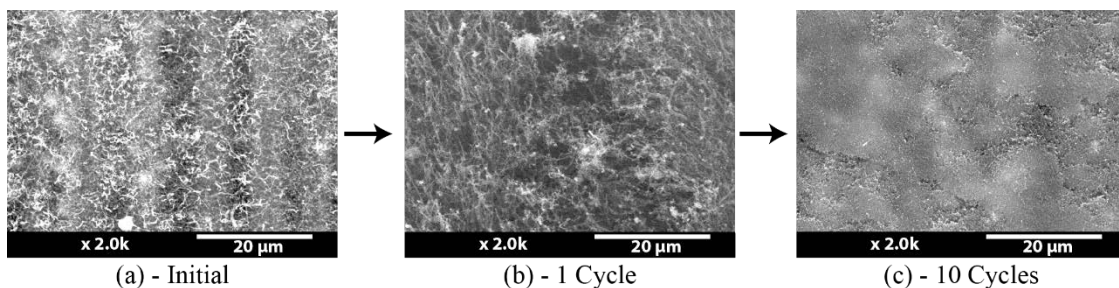


Figure 1: Wear of the CNTs during friction.

In industrial stresses of friction (around 10 cycles), the wear of the surface, whatever the catalyst used, will let the CNTs under a transfer film state [4]. EDX analysis shows that the chemical composition of the worn CNTs is not different from the initial CNTs, so no chemical modification appears during friction. Moreover Raman spectra of worn CNTs are similar to the spectra of initial CNTs, so the transfer film is composed of CNTs, and friction does not create defects on the CNTs.

The results of wettability show the impregnation of the resin with the unworn and worn surfaces and that the catalyst influences the rapidity of the impregnation. In the end, we can predict the same spreading of the resin and no decrease in the mechanical properties of the composites fabricated with worn CNTs grafted carbon fibers.

REFERENCES

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