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Composite With Improved Dispersion Of Single Walled Carbon Nanotubes In Liquid Crystalline Molecules

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Since their discovery in 1991, carbon nanotubes (CNTs) attract tremendous scientific interest. CNTs are nanodimensional objects, possessing excellent electrical, optical and thermal properties, large area, and a broad temperature range of thermal stability, making them promising for environmental, electrical, optical, biomedical, and etc. applications [1].

The main challenge to realize a successful CNT application is to achieve a homogeneous dispersion, since due to their very strong attraction they tend to re-aggregate and re-bundle [2]. Hence the stability of the CNT suspension is of great concern.

Different approaches have been adopted in resolving this issue. One pathway is to functionalize the CNTs2 improving their solubility in liquid media. Unfortunately, introducing functional groups attached to the CNT surface leads to a change in some of the CNT excellent native properties. Another important issue is to find an appropriate solvent, taking into account the CNT hydrophobicity. Previous results show that polar organic molecules, such as DMF and NMP [3,4] are the best candidates but it still depends on the synthesis method and type of the CNTs. In addition, homogeneous dispersions are possible only at very low concentrations. Successful dispersing of CNTs has been claimed by polymer assistance.

A new one promising concept is using liquid crystals (LCs). The main advantage of employing LCs is related to their long range orientational order that may help to disperse more effectively and even align the CNTs. Additionally, the properties of LC may enhance or modify those of the CNTs.

In the present study, a composite of single walled carbon nanotubes, SWCNTs (Meijo, Japan) and newly synthesized thermotropic liquid crystalline ((R,E)-4-(4-((3,7-dimethyloctyl) oxy) styryl) phenyl 4-(undecyloxy) benzoate) [5], SB(3R)-11 was prepared from an ultrasonicated solution of NMP. As a result, the composite, after solvent evaporation, contained 1 wt. % SWCNTs. Differential scanning calorimetry, Raman spectroscopy, and Polarised optical microscopy were employed to investigate the composite. The results showed that the composite still exhibit LC states but the thermal stability and number of phase transitions were strongly affected by the SWCNTs presence. The results indicate improved dispersion of the SWCNTs in the composite.

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