Dispersibility of multi-walled carbon nanotubes

Application

Electronic

Objective

Monitor the effect of solvent polarity and surfactant nature on dispersability of CNT

Device

TURBISCAN® LAB

INTRODUCTION

Carbon nanotubes have attracted a vast amount of attention because of their exceptional electrical, thermal and mechanical properties. Many research groups are currently working on their incorporation in various materials to enhance their physical properties. However, one of the major issue they are facing is the difficulty to disperse them. Surface modifications and addition of surfactants or polymers are commonly used to face this problem. The solvent polarity is also playing a key role in this process.

METHOD

Surface-modified multiwalled carbon nanotubes (MWCNT) are analysed in the Turbiscan LAB at ambient temperature, in order to monitor the migration behaviour of the MWCNT in three solvents of different polarity: styrene, toluene and deionised water[1], with increasing polarity.
Another set of CNT are studied varying this time the surfactant nature: sodium dodecylbenzene sulfonate (NaDDBS), trimethylammonium bromide (CTAB) and Triton X-100[2]. In this case CNT were dispersed in water.

RESULTS

1. Effect of solvent polarity

Figure 1. shows the typical transmission profiles observed for a poorly dispersible CNT. Increase of transmission over the total height of the sample is observed, which is characteristic of an aggregation phenomenon.

Figure 2. the mean value of transmission over the height of the sample is computed for various solvents. The maximum destabilisation is observed for styrene, which is a non polar solvent. On the other hand water shows less aggregation as it is more polar.

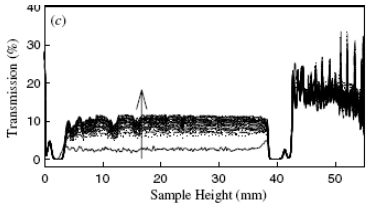

Figure 1. Transmission profiles for poor CNT dispersion

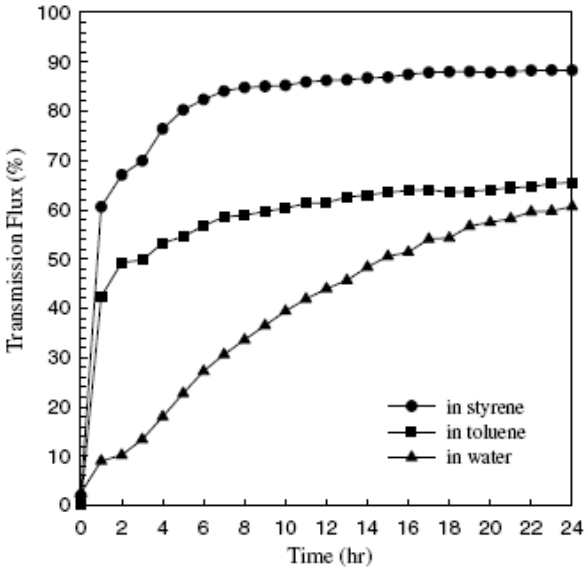

Figure 2. Effect of solvent polarity on mean value transmission