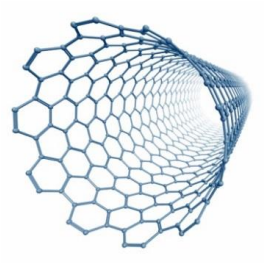

DISPERSIBILITY OF MULTI-WALLED CARBON NANOTUBES

Electronics

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 behavior of the MWCNT in three solvents of different polarity: styrene, toluene and deionized water1, 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-1002. In this case CNT were dispersed in water.

RESULTS

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.

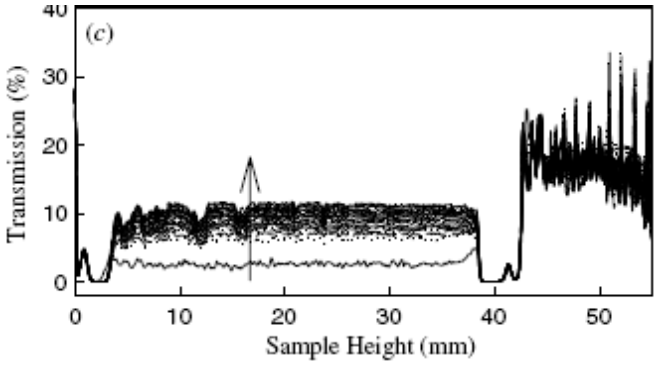

Figure 1: Transmission profiles for poor CNT dispersion

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

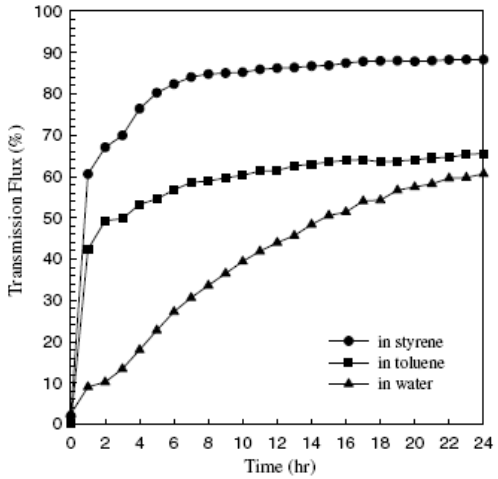

Figure 2: Effect of solvent polarity on mean value transmission

Platinum nanoparticles in IPA

Formulation 2, on the other hand, is undergoing large sedimentation (Figure 2), with an important increase of the transmission signal towards the top of the sample.

Effect of surfactant

When looking at the effect of surfactants in the dispersibility of CNT in water (Figure 3), it shows the large improvement of dispersibility with all three surfactants compared to the blank with no surfactant.

Moreover, it shows that, in this case, anionic surfactant NaDDBs is the most efficient compared to cationic (CTAB) and non-ionic (CTAB).

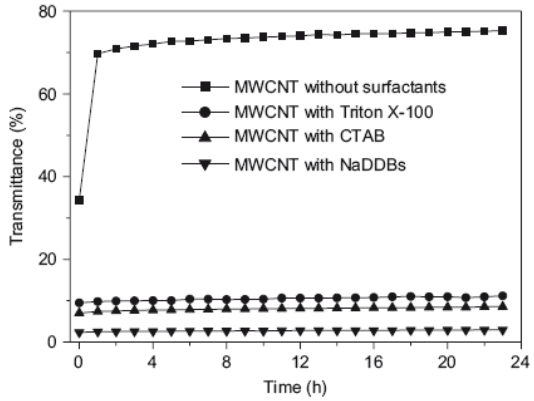

Figure 3: Effect of surfactant nature on mean value transmission.

SUMMARY

The Turbiscan LAB allows measurement of the dispersibility of CNT single or multiwalled in various conditions (solvent, surfactant, surface modification, etc.). **In less than a day** it is possible to determine which are the best conditions for CNT stability.