Transparent and conductive films of carbon nanotubes

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Transparent and conductive films of carbon nanotubes (CNTs) are under great interest for some years due to the combination of different properties as conductivity, transparency and flexibility. These thin films are investigated to use them as transparent and conductive electrodes in flexible electronic devices.

There are several methods to disperse CNTs such as aqueous dispersion with surfactant, or acid treatment of the CNTs but these techniques tend to damage the nanotubes, reducing the performances of the end material.
In this study, carbon nanotubes were dispersed in an organic solvent by a mild dissolution route[1] : the reduction of CNTs with alkali metals allows dissolution in a solvent without the need of mechanical energy, detrimental to nanotubes. In particular, CNTs are *not* shortened by the mild dissolution process and no additional defects are introduced.

A comparative study was undertaken on films obtained from both dispersions and solutions using single-, few- and multi-walled NTs. Films were obtained by a filtration method and transfer on transparent substrates[2,3]. The transparency of the films has been investigated by UV-visible spectroscopy and linked to the conductivity. Films obtained from solutions show a decrease of one order of magnitude of the surface resistance when compared to dispersions for the same transparency, reaching 105 Ohm/sq at 80% of transmittance for single-walled tubes enriched in metallic NTs.
Our study shows the advantage of the mild dissolution of NTs to prepare transparent and conductive films giving performances close to ITO'ones without any post treatment or any doping of our films.

References

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