Stability of graphene dispersions

- Study of polymer-assisted exfoliation -

Introduction

Two-dimensional graphene is of great interest in various fields: composites, barrier coatings, solar cells, transistors, biomedical applications. This material of nanometric thickness offers remarkable mechanical properties but its mass production at a reasonable cost remains a challenge. Mechanical or chemical exfoliation of graphite may be a promising solution.
This intercalation process, resulting in the complete separation of the material's layers, suffers however from several drawbacks, such as reaggregation of graphite platelets or migration of surfactant molecules, which could be a source of reduced material properties. This paper describes how Turbiscan® technology can be used to study the stability of graphene platelets dispersions (GPD) to detect nascent evolutions and select best suited polymer to stabilize the dispersion.

KEY **BENEFITS**

- FAST
- NO DILUTION
- SENSITIVE

Reference

Y. Kim et al. «A Study on amphiphilic fluorinated block copolymer in graphite exfoliation using supercritical CO2 for stable graphene dispersion » *J of Colloid and Interface Science 510* (2018): 162-171

Reminder on the technique

Turbiscan® technology, based on Static Multiple Light Scattering, consists on sending a light source (880nm) on a sample and acquiring backscattered (BS) and transmitted (T) signal all over the sample height. By repeating this measurement over time at adapted frequency, the instrument enables to monitor physical stability.
The signal is directly linked to the particle concentration (φ) and size (d) according to the Mie theory knowing refractive index of continuous (n_f) and dispersed phase (n_p):

$$\boldsymbol{BS} = \boldsymbol{f}(\varphi, \boldsymbol{d}, \boldsymbol{n_p}, \boldsymbol{n_f})$$

Method

The dispersions were prepared with an amphiphilic fluorinated block copolymer PTFEMA-*b*-PVP in supercritical CO_2 at different concentrations and molecular weights. The affinity between the polymer and the platelets contributes to keeping the dispersion stable (the platelets remain in independent state).

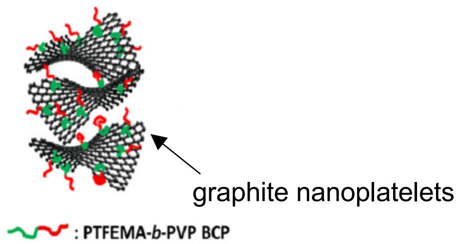

Figure 1: Exfoliation of graphite nanoplatelets with PTFEMA in supercrititcal CO_2

In this note, six dispersions at 1.6% concentration of graphite were prepared in methanol.

Sample name	Description
GD	Graphite Nanoplatelets Dispersion
GT	GD $SCCO_2$-treated without the block copolymer
G5L	GD $SCCO_2$-treated with 5% of the block copolymer at low molecular weight (L)
G10L	GD $SCCO_2$-treated with 10% of the L block copolymer
G5H	GD $SCCO_2$-treated with 5% of the block copolymer at high molecular weight (H)
G10H	GD $SCCO_2$-treated with 10% of the H block copolymer

Table 1: Sample description and composition details

Samples were analyzed at 30°C using Turbiscan®.