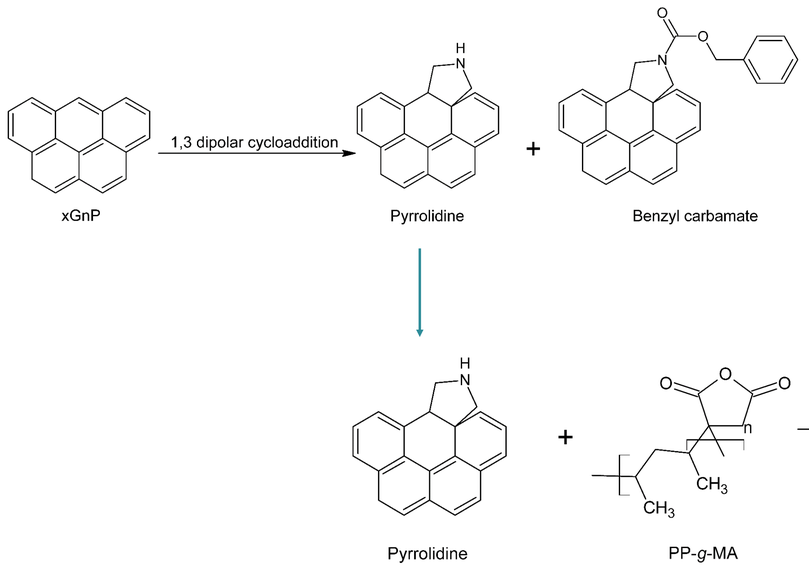
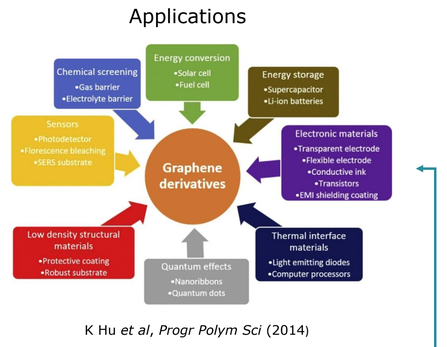
Dispersion and agglomeration of graphene nanoplatelets xGnP-*g*-MA in polymer-based composites





K Hu *et al*, *Progr Polym Sci* (2014)

Compounding and Processing

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Objectives

- Analyse the dispersion level and eventual agglomeration of graphene nanoplatelets upon melt mixing.
- Study the effect of surface modification on the dispersion and interface with the polymeric matrix.

Experimental

Materials:

- Polypropylene (PP) - Icorene CO14RM® (Ico Polymers, France).
- Graphene nanoplatelets xGnP® Grade C (Xg Sciences, Inc., Lansing).
- Polypropylene-*graft*-maleic anhydride (PP-*g*-MA) (Sigma-Aldrich).

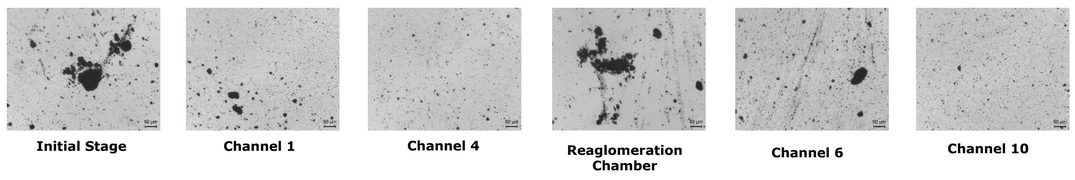
Nanocomposites preparation:

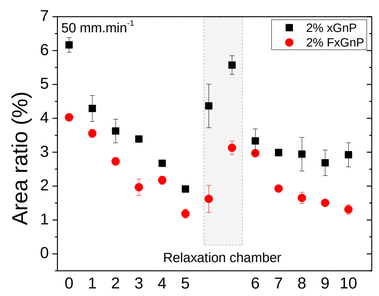
- Composites containing 2 and 10 wt.% of xGnP-*g*-MA were prepared by melt mixing using an extensional mixer attached to a capillary rheometer.
- Geometry: 1st set of rings - 8:1 convergence, followed by a relaxation chamber and a 2nd set of rings - 8:1 convergence.
- Temperature: 200 °C.
- Ram speed: 50 mm.min^{-1}.

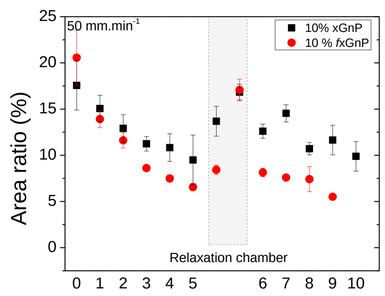
Results

Optical microscopy

Optical micrographs illustrating the dispersion degree along the convergent/divergent set-up for PP/2 wt.% of functionalized xGnP-*g*-MA.

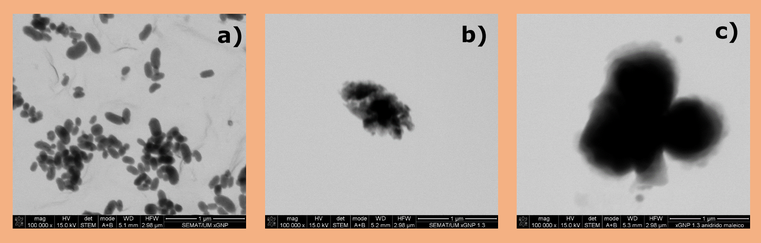






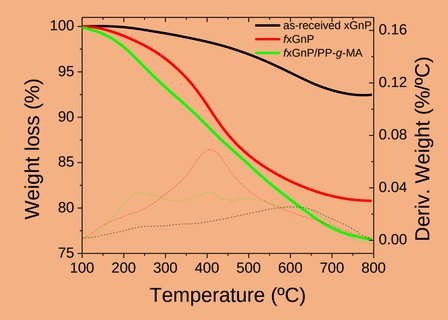
- xGnP-*g*-MA enhances dispersion and delays re-agglomeration.
- Re-agglomeration seems to affect the subsequent dispersion rate (at comparable area ratio levels).

Scanning transmission electron microscopy - STEM



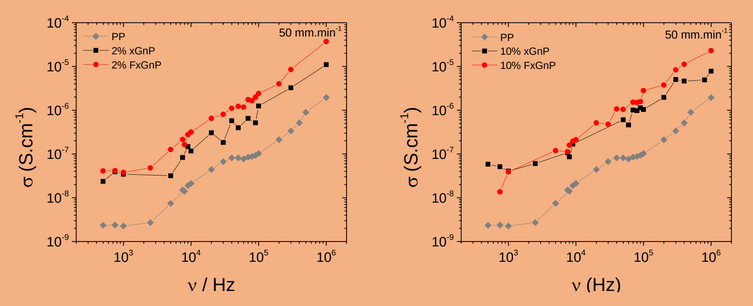
STEM micrographs of a) as-received, b) functionalized *via* 1,3 dipolar cycloaddition and c) functionalized xGnP followed by grafting with maleic anhydride.

Thermogravimetric analysis - TGA



- TGA curves of as-received and chemically modified graphene nanoplatelets.

Electrical conductivity



- Addition of xGnP improves only moderately the electrical conductivity of the material. However, better results were achieved with functionalized xGnP-*g*-MA.
- Electrical conductivity seems to be independent of the incorporation level of xGnP up to 10 wt.%.

Acknowledgments

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