Functionalized Graphene by Cold Plasma Processing

Sarah Moghari, Robert Feher

Graphit Kropfmühl GmbH, Langheinrichstrasse 1, 94051 Kropfmühl, Bavaria, Germany

info@gk-graphite.com

Abstract

Graphite, subjected to a modified Hummers process [1] and thermal treatment, yields reduced graphite oxide with different lateral sizes dependent on the starting graphite. Expanded graphite can be regarded as a flexible type of graphite with an intermediate number of layers between graphite and graphene. However, some properties like polarity and dispersion behaviour of this material are not suitable for applications where a good bonding of the FL-graphene to a host material is essential.

Plasma functionalization is a versatile technique which does not require strong chemicals like the wet-chemistry process and does not change the morphology of the substrate [2]. In our work we are using the surface functionalization with cold plasma technology in order to create amine or carboxyl groups on FL-graphene and expanded graphite. The functionalization success is verified by XPS measurements. The effect of functionalization on the dispersion stability in aqueous systems is investigated.

A potential application is shown where the functional groups have a positive effect on the material properties. In graphene filled paper used as electrodes in waste water treatment, amine and carboxyl groups lead to a higher mechanical strength of the paper. To give another example, the reinforcement of composite materials has also been proven when filling epoxy with functionalized graphene [3].

References

[1] William S. Hummers, Richard E. Offeman, J. Am. Chem. Soc. 80(6) (1958)1339.
[2] R. d'Agostino et al., Plasma Processes and Polymers 2(1) (2005) 7-15
[3] Ming-Wei Lee et al., Journal of Composite Materials 50(27) (2016) 3779–3789

Figures

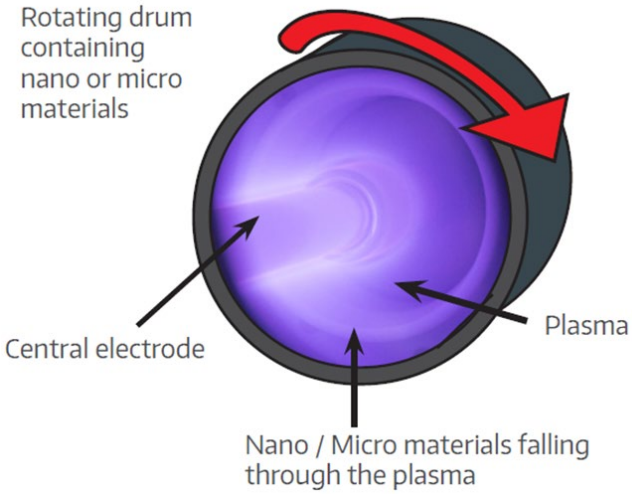

Figure 1: Cold Plasma Reactor

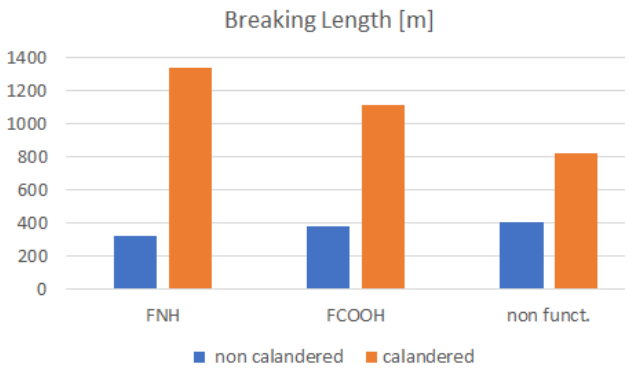

Figure 2: Paper breaking length for functionalized and pristine graphitic fillers