Production of Nitrogen Doped Graphene Oxide

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Abalonyx, established in 2005, has worked extensively with synthesis and characterization of graphene oxide (GO) and reduced graphene oxide (rGO). Specifically, GO is produced according to a proprietary modified Hummer method from different raw materials, subjected to size fractionation and further surface chemical modification by ultrasound, heat treatment, washing, dialysis and addition of surface active reagents. Abalonyx has also successfully scaled up its production capacity for rGO from lab-scale of about 25 g/day to 0.5 Kg/day. This has been achieved by arranging continuous feeding of GO-powder into an oven with an automated powder dozer.

Abalonyx has started production of new series of functionalized/ doped products for specific applications. As an example, nitrogen doped graphene derivatives have received attention recently due to their use in electrolyte membrane fuel cell applications. It is worth mentioning that introduction of N to GO/rGO results in three primary N- bonding configurations including the pyridinic N, pyrrolic N, graphitic N and N-oxides. Both quaternary N and pyridinic N moieties have been suggested to facilitate oxygen reduction reaction (ORR).

Abalonyx is a partner of an EU project entitled **"NanoElMem"**and our main task is production of NGO/NrGO. For this purpose two different approaches were selected. In the first one, a simple, rapid and scalable wet-chemical method was selected for the synthesis of NGO only by ultrasonic treatment of GO in aqueous solution of ammonia and in the second approach, GO was placed in a chamber and exposed to NH3 gas in a "cold" plasma generator. The experiment was done at room temperature. A comprehensive characterization study was done (The FTIR and XPS spectra for our GO and NGO has been shown in Figure 1 and 2 as examples). This work compares the results obtained for Synthesis of NGO by ultrasonic and plasma treatment.

References

www.abalonyx.no

[1] H. Tao, C. Yan, A.W. Robertson, Y. Gao, J. Ding, Y. Zhang, T. Ma, Z. Sun, N-Doping of graphene oxide at low temperature for the oxygen reduction reaction, Chem. Commun. 53 (2017) 873–876.

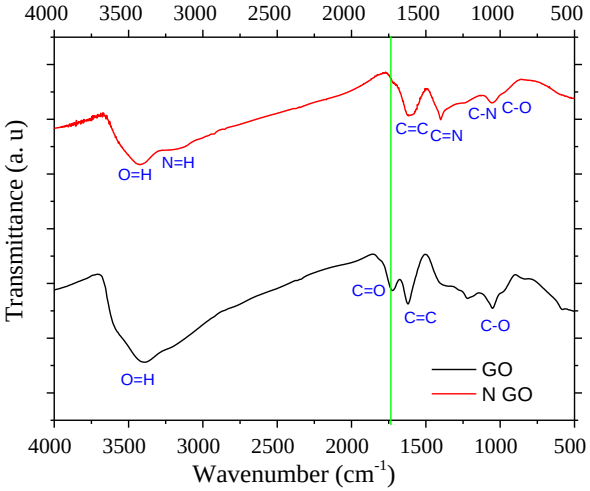

Figure 1: *FTIR spectra of GO and NGO.*

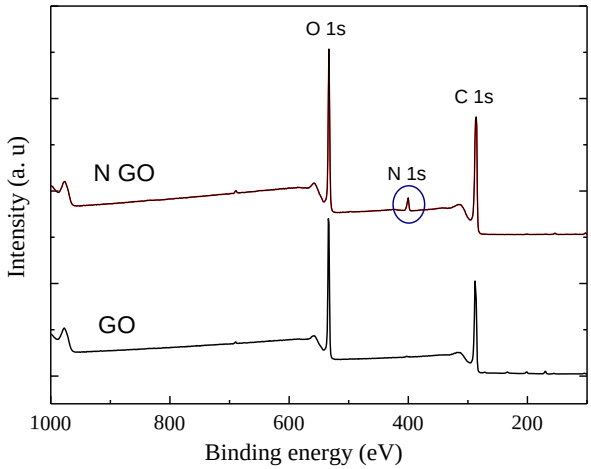

Figure 2. *Wide-survey XPS spectra of GO and NGO samples.*