PREPARATION AND CHARACTERIZATION OF POROUS GRAPHENE-OXIDE FRAMEWORKS

E. Amayuelas[1] and C. O. Ania[1,]

[1] POR2E Group, CEMTHI (CNRS UPR 3079) Université d'Orléans, 45071, Orléans, France

([*]email : eder.amayuelas-lopez@cnrs-orleans.fr)

Nanoporous carbons have become key materials in the field of electrochemistry as a result of their exceptional characteristics (surface area, biocompatibility and mechanical and chemical stability) [1, 2]. However, the performance of most nanoporous carbons is still a drawback.[3] Thus designing pre or post-synthetic strategic towards the enhancement of the electronic conductivity of nanoporous carbons are a largely investigated topic. In this context, graphene-oxide frameworks (GOFs) arose as promising materials with these desired properties. GOFs consist of graphene oxide (GO) layers covalently linked by organic molecules [4], thereby providing a 3 D porous structure. As a result, GOFs exhibit controllable pore sizes and tuneable d-spacing of GO sheets which can lead to high surface areas and versatile electronic behaviors [5-6].

Bearing this in mind, the objective of this work was to explore this strategy to obtain new materials with improved features. We have used a hydrothermal approach for the preparation of the GOFs with different organic linkers with special focus on their functional groups. Depending on their molecular structure and concentration, we studied the role of these organic building blocks in the d-spacing between GO layers, their bonding and the surface area. Furthermore, we have explored the effect of the defects present on the GO precursor in the porosity of the resulting material, by using various synthetic procedures for the preparation of the GO (i.e., chemical, photochemical and electrochemical oxidation of graphite). A screening of these features allowed us to select GOFs with optimal surface area and electrochemical properties.

Acknowledgments. This work has been funded by the European Research Council through a Consolidator Grant (ERC-CoG 648161, PHOROSOL).

References

[1] D. R. Dreyer, S. Park, C. W. Bielawski, R. S. Ruoff (2010), Chem. Soc. Rev., 39, 228.
[2] E. Frackowiak, F. Béguin (2001), Carbon, 39, 937–950.
[3] A.G. Pandolfo, A.F. Hollenkamp (2006), J. Power Sources, 157, 11–27.
[4] G.X. Wang, Z.P. Shao, Z.L. Yu (2007), Nanotechnology, 18 (20), 205705.
[5] J. W. Burress, S. Gadipelli, J. Ford, J. M. Simmons, W. Zhou, T. Yildirim (2010), Angew. Chem., Int. Ed., 49, 8902.
[6] M. Razmkhah, M.T. H. Mosavian, Fatemeh Moosavi, A. Ahmadpour (2018), Appl. Surf. Sci., 456, 318.