From nanostructured conducting polymers to reduced graphene oxide composites: a radiolytic strategy

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Conducting polymers which are usually prepared by chemical or electrochemical ways, represent one of the most investigated classes of functional π-conjugated systems due to their interesting physicochemical characteristics and the wide technological applications in which they are involved. Few years ago, we succeeded in the development of an original radiolytic methodology, based on gamma-rays[1,2,3] or accelerated electrons[4,5], for the preparation of nanostructured conducting polymers in aqueous solutions. We subsequently extended our strategy to the synthesis into organic media of conducting polymers[6,7,8] and copolymers[9] with enhanced physicochemical properties.

On another hand, thanks to their exceptional properties, graphene and many of its composites are considered as revolutionary materials with potential impacts on all industrial sectors, such as energy storage. Elaboration of graphene-based materials is thus the subject of intense research activity. In this context, starting from commercial graphene oxide, we recently developed a new original radiolytic route which enabled us to produce highly reduced graphene oxide[10]. Finally, our radiation-based methodology was extended to the one-pot preparation of hybrid nanocomposites, made of both reduced graphene oxide and conducting polymers.

Interestingly, thermal stability and capacitive properties of these composites are found truly remarkable. These results bear witness to the tremendous potential of our radiolytic methodology and give us a glimpse of future promising industrial applications, especially in the field of energy storage.

References

1. Y. Lattach, A. Deniset-Besseau, J.M. Guigner, S. Remita, *Radiat. Phys. Chem.* **2013**, 82, 44-53
2. Z. Cui, C. Coletta, A. Dazzi, P. Lefrançois, M. Gervais, S. Neron, S. Remita, *Langmuir* **2014**, 30, 14086-14094
3. Y. Lattach, C. Coletta, S. Ghosh, S. Remita, *ChemPhysChem* **2014**, 15, 208-218
4. C. Coletta, Z. Cui, P. Archirel, P. Pernot, J.L. Marignier, S. Remita, *J. Phys. Chem. B* **2015**, 119, 5282-5298
5. C. Coletta, Z. Cui, A. Dazzi, J.M. Guigner, S. Néron, J.L. Marignier, S. Remita, *Radiat. Phys. Chem.* **2016**, 126, 21-31
6. T. Bahry, Z. Cui, A. Deniset-Besseau, M. Gervais, C. Sollogoub, T.T. Bui, S. Remita, *New J. Chem.* **2018**, 42, 8704-8716
7. T. Bahry, Z. Cui, A. Deniset-Besseau, M. Gervais, I. Mbomekalle, C. Sollogoub, P.H. Aubert, T.T Bui, S. Remita, *New J. Chem.* **2020,** 44, 11652-11666
8. T. Bahry, Z. Cui, A. Dazzi, M. Gervais, C. Sollogoub, F. Goubard, T.T. Bui, S. Remita, *Radiat. Phys. Chem.* **2021,** 180, 109291-109302
9. T. Bahry, B. Khurshid, Y. Chouli, S. Abou-Zeïd, C. Sollogoub, M. Gervais, T.T. Bui, F. Goubard, S. Remita, *New J. Chem.* **2021,** 45, 13142-13157
10. S. Abou-Zeïd, S. Bencherif, R. Ghasemi, R. Gogoi, Y. Chouli, M. Gervais, D. Dragoe, J. Ghilane, P.F. Siril, S. Remita, *New J. Chem.* **2024,** 48, 4749-4764