GDR HOWDI 2022 MEETING: SYNTHESIS AND OPTICAL PROPERTIES OF ROD-SHAPED GRAPHENE NANOPARTICLES

D. Medina Lopez[1], T. Liu[2], S. Osella[4], C. Elias[2], L. Rondin[2], D. Beljonne[3], J.-S. Lauret[2] and S. Campidelli[1]

[1]Université Paris-Saclay, CEA, CNRS, NIMBE, LICSEN, 91191 Gif-sur-Yvette Cedex, FRANCE
[2] Université Paris-Saclay, ENS Paris-Saclay, Centrale Supelec CNRS, LUMIN, 91405, Orsay Cedex, FRANCE
[3]CMN, Université MONS, BELGIUM
[4]Chemical and Biological Systems Simulation Lab, Centre of New Technologies, University of Warsaw, ul. Banacha 2C 02-097 Warsaw, POLAND

Since its discovery, graphene has been positioned as a promising material because of its good mechanical, thermal and electrical properties, among others. Nonetheless, applications in optics and optoelectronics remain a challenge because of the absence of a bandgap. A solution to this problem is to reduce the size of graphene to a nanometric scale; thus, we shine our interest in Graphene Quantum Dots (GQDs). There are two general approaches for the synthesis of GQDs: top-down and bottom-up. On the one hand, top-down synthesizing (lithography, hydrothermal and electrochemical approaches) can be cheap and efficient at the expense of precise control of the size, shape, and edges of the GQDs.[1] On the other hand, bottom-up synthesis yields precise and controlled structures. Bottom-up graphene materials have developed exponentially for the last decade with the synthesis of highly controlled graphene nanoribbon structures and moderately soluble graphene quantum dots.[2,3] Our group demonstrated that bottom-up GQDs could act as single-photon emitters exhibiting high brightness and stability.[4]

To better understand the structure-optical properties relationship, we designed a series of elongated rod-shaped graphene nanoparticles that differ only by length while keeping the same morphology, symmetry, and edge states (see figure). These nanoparticles exhibit a high solubility, which facilitates their purification and individualization in solution giving well-defined absorption spectra. Here, we report on the synthesis of these GQDs and present results on their advanced optical characterization complemented with their theoretical description.[5]

References

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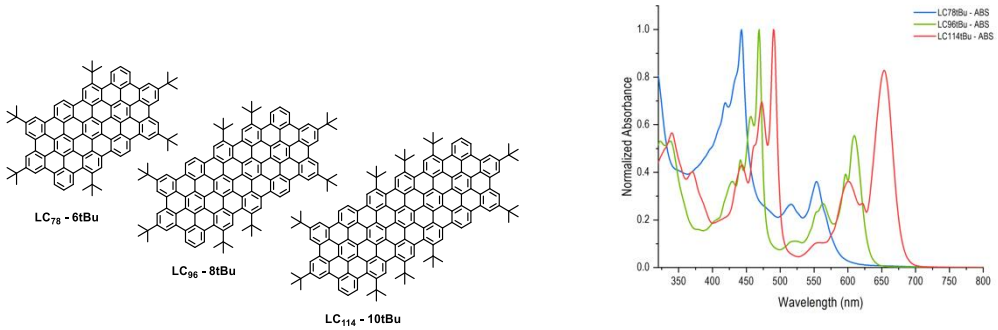

Figure 1: Structures and absorption spectra of rod-shaped GQDs: LC_{78} - 6t-Bu (blue), LC_{96} - 8t-Bu (green) and LC_{114} - 10t-Bu (red).

corresponding author : daniel.medina-lopez@cea.fr