SYNTHESIS, CHARACTERISATION AND SELF-ASSEMBLY OF SMALL CARBON QUANTUM DOTS FOR A BINARY SYSTEMS APPLICATIONS

Barbara Śliwa[1], Kacper Ornat[1], Agnieszka Jędrych[1], Michał Wójcik[1]

[1]Department of Chemistry, University of Warsaw, Poland
b.sliwa2@student.uw.edu.pl

Carbon quantum dots (CQDs) are carbon-based fluorescent nanomaterials with a size-dependent optical properties and have attracted attention in many applications such as light-emitting diodes, solar cells, sensing and bioimaging [1-3]. It has been shown that spherical nanoparticles can organize into many diverse soft structures when substituted by mesogenic ligands, due to the self-segregation of chemically non-compatible units [4]. Condensed aggregates of periodically organized nanoparticles are one of the most important research topics for the development of electronics, plasmonics and remote-control hybrid nanomaterials [5]. The range of application could be wide if the elements making these arrays formed large-scale and well-defined structures. The type of structure can be controlled by composition of organic layer and temperature as well as by the metal core size and density of grafting layer [6].

Carbon quantum dots incorporated hybrid nanomaterials (binary systems with plasmonic nanoparticles) possessing liquid crystalline properties have been proposed. To prepare the binary system the synthesis of small and monodispersed carbon quantum dots has been carried out. During the research several synthetic approaches have been applied to obtain purified quantum dots for future doping of liquid-crystalline hybrid binary system. CQDs have been characterized with SAXRD, TEM, UV_VIS and IR spectroscopy techniques. In this presentation, we will focus on a novel approach for synthesis and X-ray (SAXRD) characterization of carbon quantum dots suitable for self-organizing materials.

[1] H. T. Li, X. D. He, Z. H. Kang, H. Huang, Y. Liu, J. L. Liu, S. Y. Lian, C. H. A. Tsang, X. B. Yang and S. T. Lee, Angew. Chem., Int. Ed., 2010, 49, 4430–4434.

[2] S. T. Yang, Li Cao, P. G. Luo, F. S. Lu, X. Wang, H. F. Wang, M. J. Meziani, Y. F. Liu, G. Qi and Y. P. Sun, J. Am. Chem. Soc., 2009, 131, 11308–11309

[3] Y. Z. Yang, X. F. Lin, W. L. Li, J. M. Ou, Z. K. Yuan, F. Y. Xie, W. Hong, D. S. Yu, Y. G. Ma, Z. G. Chi and X. D. Chen, ACS Appl. Mater. Interfaces, 2017, 9, 14953–14959.

[4] M. Wojcik, W. Lewandowski, J. Matraszek, J. Mieczkowski, J. Borysiuk, D. Pociecha, E. Gorecka; Angew. Chem. Int. Ed. Engl., 2009, 48, 28, pp. 5167–9

[5] W. Lewandowski, M. Fruhnert, J. Mieczkowski, C. Rockstuhl, E. Górecka; Nat. Commun. 2015; 6:6590

[6] A. Zep, M. Wojcik, W. Lewandowski, K. Sitkowska, A. Prominski,J. Mieczkowski, D. Pociecha, E. Gorecka; Angew. Chem. Int. Ed. 2014, 53, 13725 –137