

Synthesis of Carbon Dots for Bio- and Technological Applications

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This project aims at studying new carbon dots with improved properties. Applications are envisioned for photonic, bioimaging and drug delivery purposes.

Carbon dots are carbon-based quasi-spherical nanoparticles below 10 nm in size. They have low toxicity and, in contrast to other carbon-based nanomaterials, they display excellent water solubility [1]. For these reasons, our group is particularly interested in developing new strategies to synthesize carbon dots for applications in biology and technology.

The synthesis of carbon dots is typically performed with a simple and inexpensive microwave reaction [2]. In this process, different organic precursors are chosen (e.g. amino acids, small aromatic and aliphatic molecules) to tailor the properties of the targeted material. The same strategy can be extended to target applications in biology, in particular for interactions with cells and drug delivery. Interactions with cells and mechanisms of cell penetration will be developed in collaboration with other groups, at national and international level.

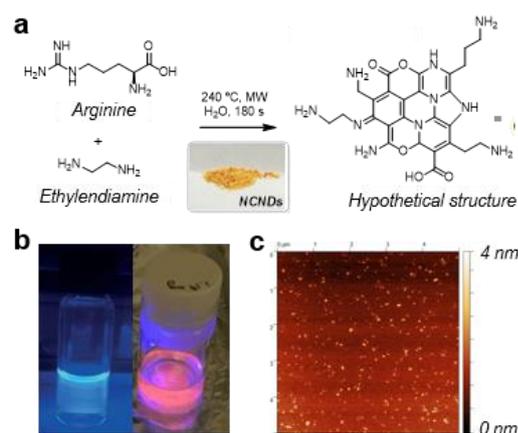
By working on this project, the PhD student will become fluent in synthetic and polymer chemistry, materials science and basic biology. The designed materials will be characterized using state-of-the-art spectroscopy and microscopy techniques. Specifically, fluorescence, brightfield, scanning electron, and atomic force microscopies will be extensively used to characterize the new carbon dots and their interactions with cells. For the optimal development of collaborative projects, it is likely for PhD students to perform a research stay abroad.

Our group is a lively and stimulating environment, committed to interdisciplinarity: the student will be exposed to several aspects of nanotechnology and bio-materials science. Typically, the PhD work starts from an ongoing project. Then, the individual interests and attitudes of the student come into play and will shape the development of their path into groundbreaking research.

Currently, a few members of the group are involved in this frontier research line, thus creating the correct atmosphere for the professional development of new members. Our group is committed to interdisciplinarity and the student will be exposed also to other fields related to nanomaterials, that represent the group core expertise.

References:

- [1] "Design, synthesis, and functionalization strategies of tailored carbon nanodots", F. Arcudi, L. Đorđević, M. Prato, *Acc. Chem. Res.* **2019**, 52, 2070.
- [2] "Preparation, functionalization and characterization of engineered carbon nanodots" L. Đorđević, F. Arcudi, M. Prato, *Nature Protoc.* **2016**, 14, 2931.



Carbon dots: (a) typical synthetic strategy; (b) blue and red-emitting carbon nanodots; (c) AFM image of the studied material.