Nanocomposites and nanomaterials
New carbon nanomaterials: carbon dots as new class of fluorophores.

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Fluorescent carbon dots (C-dots) are versatile and less defined nanocarbon materials. They attracted many researchers just because of their simple syntheses achievable by many approaches from many starting organic materials. On the steps of their synthesis the obtained particles may incorporate on their surface hydroxyls, carbonyls and carboxy groups. Importantly, the one-step synthesis allows locating in addition to carboxylic groups (which is common), the reactive amino groups, and this strongly facilitates their functionalization.

The C-dots studied in this work display both common and specific spectroscopic properties. Common is the very strong absorbance in the UV range and the absence of comparable level of absorbance at the wavelengths of maxima of excitation spectra. In our work, detailed study of fluorescence intensity, lifetime and time-resolved anisotropy as a function of excitation and emission wavelengths was performed for three types of C-dots with “violet”, “blue” and “green” emissions (405 nm, 450 nm, 530 nm respectively). They demonstrate the presence within the nanoparticles of distribution of individual emitters that do not exchange their excited-state energies via FRET mechanism. We demonstrate that contrary to views of many scientists, the C-dots are not ‘quantum dots’ and even not the ‘dots’, since they are far from being zero-dimension emitters, and their fluorescence response is not collective. According to the present results, they are nanosized clusters assembling individual fluorophores.

Due to simple and cheap synthesis and stability in aqueous medium, high photostability, the absence of toxicity and multiple possibilities for their chemical modifications, the carbon nanoparticles can be efficiently used in various fields of science and technology substituting traditional luminophores.

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