

Using carbon dots as light harvesters and light emitters in functional nanocomposites: current developments and future perspectives

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Abstract

Carbon nanodots (CDs) have been emerging in the last 15 years as a new family of zero-dimensional carbon nanomaterials displaying several interesting optical properties, such as a bright and tunable fluorescence and a strong tendency of behaving as photo-activated charge donors. Besides, CDs display several key advantages with respect to other optical nanomaterials, such as non-toxicity, low cost and ease of synthesis. Since their original discovery in 2006, CDs have been attracting a large and interdisciplinary research interest in nanoscience. Many groups are currently pursuing their application in multiple fields, such as optoelectronics, photocatalysis, bioimaging and sensing. Yet, the fundamental nature of CD optical transitions remains very debated.

In this talk I will present a selection of the studies on CDs conducted by our group in the last five years. We have been addressing the fundamental photophysics of CDs, with the goal of pinpointing the microscopic mechanisms responsible of their bright fluorescence and relating them to their underlying chemical structures. In recent times, we have been focusing more and more on devising strategies to couple CDs to other nanomaterials, such as carbon nanotubes, polyoxometalates, metallic and magnetic nanoparticles. The results are very promising and confirm the excellent properties of CDs as artificial light harvesters, light emitters, and photo-excited charge donors in the design of functional nanocomposites.