Preparation of Carbon Quantum Dots with Tunable Photoluminescence by Rapid Laser Passivation in Ordinary Organic Solvents

Xiangyou Li, Hongqiang Wang, Yoshiki Shimizu, Alexander Pyatenko, Kenji Kawaguchi, Naoto Koshizaki
National Institute of Advanced Industrial Science and Technology (AIST),
Central 5, 1-1-1 Higashi, Tsukuba, Ibaraki 305-8565 Japan

Quantum dots (QDs) have good properties due to its quantum size confinement effect and are finding increasing applications in modern biotechnology (such as biomarker, biosensing, bioimaging) and medicine. However, the known cytotoxicity (e.g., with CdSe and CdTe QDs), potential environmental hazards and strict synthesis conditions restricted their further developments.

In recent years, quantum-sized carbon has also been attracted extensive investigations due to the low toxicity in vivo. Conventional preparation methods often need complex procedures (two or more steps) and long time passivation, which make it not effective. In this paper, carbon QDs with visible, stable and tunable performance was prepared by laser irradiating carbon nano particles in simple ordinary chemical solvents. Comparing with other methods, it is simpler and easier and more effective because of its unfocusing features. HR-TEM was used to observe the morphology and XPS analysis results showed that the passivation effect by laser irradiation played a very important role in the origin of PL. This method shows high potential for fabricating new luminescent materials and may be used into many fields such as biology and imaging.