

## Photothermal Carbon Dots for Diagnostics and Therapeutics

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Nanoparticles have been widely investigated for biomedical applications, such as imaging, therapy, and drug delivery. However, photostability and safety issues have been the technical hurdles for further clinical applications. In this regard, carbon dots (C-dots) have been the subject of extensive research because of their biocompatibility and photostability. Here, I introduce photothermal C-dots and their diagnostic and therapeutic applications. The electronic structure of C-dots can be engineered by doping atoms of lone pairs of electrons such as boron, nitrogen, and oxygen to induce intra-gap states. These intra-gap states serve as defective states that could trap excited electrons to generate phonons or heat through a process called non-radiative recombination. Using heat from C-dots, we perform in vitro/in vivo photoacoustic imaging and photothermal therapy. The renal clearance of C-dots is confirmed by the whole-body monitoring, and then they are used to detect early hepatocellular carcinoma. Finally, tumors are treated by photothermal therapy, and its therapeutic efficacy is evaluated.