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C_8-structured carbon quantum dots: Synthesis, blue and green double luminescence, and origins of surface defects CHEN XIFANG, ZHANG WENXIA, Department of Physics, Southeast University, Nanjing 211189, PR China, WANG QIANJIN, National Laboratory of Solid State Microstructures and Department of Materials Science and Engineering, Nanjing University, Nanjing 210093, PR China, FAN JIYANG, Department of Physics, Southeast University, Nanjing 211189, PR China — Carbon quantum dots (CQDs) have attracted great attention in the past few years due to their low cytotoxicity, exploited various synthesis methods, unexampled abundance of raw materials on earth, and robust near-infrared to near-UV luminescence. Carbon nanoparticles have applications in biological labeling, delivery of drugs and biological molecules into cells, and light emitting diodes and lasing. CQDs generally exist as nanodiamonds or graphite quantum dots according to previous research reports. In this study, we report the first synthesis of the third-allotrope CQDs through carbonization of sucrose and study their luminescence properties. These CQDs have a body-centered cubic structure and each lattice point is composed of eight atoms which form a sub-cube (so called C_8 crystal structure). High-resolution transmission electron microscopy and X-ray diffraction confirm the C_8 structure of the synthesized carbon nanocrystallites with an average size of 2 nm. The C_8 CQDs exhibit double-band luminescence with two peaks centered at around 432 and 520 nm. The study based on the photoluminescence, UVVis absorption, Fourier-transform infrared, and X-ray photoelectron spectroscopies reveals that the green emission originates from the C=O related surface defect.

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