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Experimental evidence of $\alpha \rightarrow \beta$ phase transformation in SiC quantum dots and their size-dependent luminescence XIAOXIAO GUO, Department of Physics, Southeast University, DEJIAN DAI, Department of Physics, Southeast University, Nanjing 211189, PR China, BAOLU FAN, Department of Physics, Southeast University, JIYANG FAN, Department of Physics, Southeast University, Nanjing 211189, PR China — Silicon carbide (SiC) quantum dots (QDs) have attracted great interest due to their wide application in photonics, optoelectronics, and life sciences. SiC is an outstanding wide-bandgap semiconductor for applications in high power, high temperature, and high frequency electronic devices owing to its superior physical and mechanical properties. As a wide-bandgap semiconductor, SiC has over 250 crystalline structures, and some polytypes have been found in the presolar meteorites. Phase transformation can occur among different SiC polytypes under extreme conditions such as high pressure or high temperature. It remains unknown whether phase transformation can occur under normal conditions. We demonstrate that the $\alpha \rightarrow \beta$ phase transformation can occur at ambient temperature and pressure in nanoscale SiC. The microstructural characterization and light absorption and emission spectroscopy demonstrate the occurrence of this phase transformation. It is found that the quantum-confinement luminescence dominates in larger SiC QDs and the surface-defect luminescence dominates in ultrasmall SiC QDs. The rare phenomenon of photon absorption accompanied by emission or absorption of multiple phonons has been observed, demonstrating the indirect-bandgap nature of the SiC QDs.

Xiaoxiao Guo
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