Oxygen-free Pyrolysis of Aromatic Carboxylic Acid for Carbon Nanodots with Absolute Quantum Yield of 80%

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Carbon nanodots (CNDs) are unique, organic-based fluorophores prepared by a variety of carbon-containing precursors such as graphite, coal, and organic molecules. In spite of the types of precursors, however, the formation reaction of CNDs typically involves oxidative steps; as a result, CNDs have oxygen-rich cores and surfaces, regarded as one of the main reasons that the photoluminescence of CNDs is generally confined in the blue-to-green range. In this report, we have firstly revealed that the pyrolysis of aromatic carboxylic acid molecules under inert atmosphere can yield oxygen-less CNDs, which is majorly driven by decarboxylation reaction. The resulting CNDs have extremely low oxygen contents and show bright yellow-to-orange photoluminescence with absolute quantum yield up to 80%. We have finally demonstrated freestanding color filters that can cover a wide range of visible light. These findings provide a novel pathway for the formation of CNDs, and prove their potential for photonic applications.