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Novel Donut-Like Carbon Composites for the Selective Detection of Fe³⁺

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Abstract

The faint fluorescence of hydrothermal carbon microsphere (HTC) restricts its application in the field of luminescent materials. In this paper, novel HTC/zinc borate ($4\text{ZnO}\cdot\text{B}_2\text{O}_3\cdot\text{H}_2\text{O}$, ZBH) (ZBH/HTCs) composites were fabricated by hydrothermal method. The as-prepared ZBH/HTCs composites have a donut-like morphology. A large amount of oxygen-containing functional groups exist on the surface of the ZBH/HTCs composites which have been proved by Fourier Transformation infrared spectroscopy (FT-IR) and X-ray photoelectron spectroscopy (XPS). Interestingly, the ZBH/HTCs samples exhibit strong fluorescence emission. In addition, the tunable emission color provides the possibility for the preparation of white light materials. Moreover, the effects of various metal ions on the fluorescence of the ZBH/HTCs composites were investigated. The fluorescence of carbon composites shows a sensitive and selective quenching effect to Fe³⁺ ions, allowing it to be used as a fluorescent probe to detect Fe³⁺ ions with a detection limit of 49.20 nM. These results demonstrate that the ZBH/HTCs composites have great potential applications in the area of the white light-emitting diodes lighting and Fe³⁺ ions sensor.

Keywords: carbon composites, donut-like morphology, white luminescent material, Fe³⁺ detection

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