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Abstract

Europium-Doped Ceria Nanocrystals as Nanozyme Fluorescent Probes for Biosensing †

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Abstract: Molecular nanoprobes with intrinsic enzyme-like activity represent a new wave of technology for rapid and sensitive detection of molecular targets. This work reports synthesis and characterization of novel and well-dispersed europium-doped ceria nanocrystals (EuCe NCs) with self-integrated catalytic and fluorescence sensing functions. The NCs have an average size of ~5 nm and exhibit bright and stable fluorescence for more than 6 months in aqueous media. Their dual cooperative function as both a catalyst and fluorescent probe was explored to develop a universally applicable fluorescence-based biosensing method to monitor enzyme reactions and quantitatively measure clinically relevant molecules. Sensing capabilities are demonstrated for detection of H_2O_2, glucose/glucose oxidase, lactate/lactate oxidase, phosphatase activity, and the catecholamine neurotransmitter, dopamine. Results indicate that EuCe NCs not only provide high enzyme-mimetic activity, but also impart direct fluorescence sensing ability enabling all-in-one recognition, catalytic amplification, and the detection of biomolecular targets. The EuCe nanozyme offers a stable alternative to the more complex systems based on the combined use of natural enzymes and fluorescent dyes. The high stability and fluorescence detection capabilities demonstrate that EuCe NCs have the potential to be used as a generic platform in chemical and biological sensing and bioimaging applications.

Keywords: ceria nanocrystals; europium doping; nanozyme; fluorescent probe; bioanalytical applications

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