Tens nanometer scale cathodoluminescence bioimaging with rare-earth doped nanoparticles

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1. Introduction

Cathodoluminescence (CL) microscopy has a potential to visualize and distinguish specific kinds of biomolecules at higher spatial resolution than fluorescence microscopy imaging. Up to now, we have investigated multi-color CL observation with different kinds of rare-earth doped nanophosphors (NPs) \([1, 2]\). The previous results showed that small nanophosphors emit weak CL even though a few tens nm size of particles is indispensable for practical application. Therefore, the improvement of size and CL emission intensity are highly desired. We report the synthesis of highly emissive rare-earth doped NPs smaller than 50 nm and its CL imaging properties.

2. General Instructions

**Synthesis of rare-earth doped nanophosphors**

To synthesize luminescent NPs, we used urea-based homogeneous precipitation (HP) method \([3]\). HP method provides uniform and spherical phosphor nanoparticles with controllable synthesis conditions. Briefly, decomposition reaction of urea increases pH of solution and then the PH increase induces homogeneous precipitation of rare-earth occurs. Figure 1 shows the transmission electron microscopy image of synthesized \(\text{Y}_2\text{O}_3\): Eu precursors. Precursor nanoparticles sized about 46.5 ± 6.4 nm (Fig. 1, Inset). To increase CL intensity, amount of Eu concentration was changed during the synthesis. After calcination, dispersed \(\text{Y}_2\text{O}_3\): Eu NPs were obtained.

\[\text{Y}_2\text{O}_3\]: Eu NPs. The images were obtained with a field emission scanning electron microscopy (FE-SEM; JEOL, JSM-6500F) and a CL measurement unit (HORIBA). The NPs were well dispersed and five \(\text{Y}_2\text{O}_3\): Eu NPs were recognized in both FE-SEM and CL images.

3. Conclusion

We presented high luminescent NPs for high spatial resolution and multi-colored CL imaging. Less than 50 nm sized NPs were synthesized by HP method. The NPs were imaged with FE-SEM and a CL measurement unit.

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**References**

