Luminescent properties of nanoparticle-polymer composite films

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1. Introduction

The semiconductor-based nanoparticles and quantum dots have been recently recognized as one of the most promising candidates for the application in diverse optoelectronic devices such as displays, solar cells, light emitting diodes, lasers, radiation detectors and many others [1-2]. Current X-ray detection technologies still rely on expensive inorganic crystals grown at high temperature [3]. In recent years, the nanomaterials have emerged as the next-generation of radiation detection materials owing to the high absorption coefficient, band gap tunability, easy solution processes, and long carrier diffusion length [4-7]. Therefore, researchers have been actively applying various nano- and micro-scale materials to radiation detection devices to improve the performance and efficiency of the conventional radiation detection devices and overcome their limitations.

In this work, we focused on the synthesis and characterization of perovskite nanoparticle-polymer composite films for radiation detection applications. The fabrication of CsPbBr3 nanoparticle-polymer composite films is described and their optical and structural properties are investigated in details.

2. Methods and Results

The CsPbBr3 nanoparticles were synthesized using the colloidal hot-injection method and dispersed in an aqueous solution. After the synthesis the purification process was carried out several times. The nanoparticle–polymer composites were prepared by adding the CsPbBr3 nanoparticles into a toluene solution that contains dissolved polymer material. To fabricate the freestanding nanoparticle-polymer composite films, the nanoparticle and polymer solution mixture is poured into a mold and dried in an oven under vacuum. Fig. 1 shows the X-ray excited radioluminescence spectra of CsPbBr3 nanoparticle-polymer composite films to identify the X-ray reaction ability.

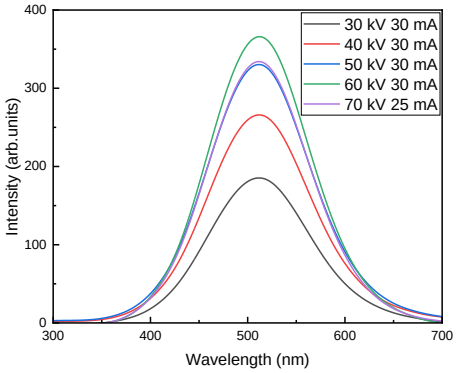

Fig. 1. X-ray excited luminescence spectra of the freestanding nanoparticle-polymer composite film.

3. Conclusions

In summary, we have presented that the preparation and characteristics of CsPbBr3 nanoparticle-polymer composite films. The fabricated freestanding film with good optical and structural properties indicates their suitability for the radiation detection applications. These results may be useful for future research and development of highly efficient radiation detection materials with low fabrication cost and excellent luminescence properties, as well as for improved performance of large-sized, stable and flexible nanomaterial-based radiation detection devices.

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