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Original Paper

Recycled Glass and Ce-Doped-$Y_3Al_5O_{12}$ Nanoparticles Phosphor-in-Glass for White Light-Emitting Diodes Applications

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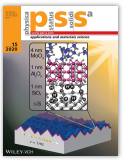
Abstract

A series of nanocomposites of recycled soda-lime glass from a glass container and $Y_3Al_5O_{12}:Ce^{3+}$ (YAG:Ce) phosphor nanoparticles are fabricated by the two-step low-temperature co-sintering technology. A transparent glass bottle from a commercial beverage is used as glass frit source and mixed with YAG:Ce nanoparticles. Afterward, the powders are pressed to obtain pellets with phosphor concentrations in the range of 2.5–15 wt%. The pellets are sintered at 800 and 900 °C. X-ray diffraction (XRD) analysis shows that YAG:Ce nanoparticles are conserved even after sintering at 900 °C. The XRD analysis shows that YAG:Ce nanoparticles are conserved even after sintering at 900 °C. The emission spectra of the Ce^{3+} ions of yttrium aluminum garnet (YAG) nanoparticles combined with the transmitted blue light exhibit color tuning related to the phosphor concentration and the sintering temperature. A tonality shift from cold-white light toward yellowish-green region is observed according to the estimated CIE 1931 chromaticity. Thus, recycled glass from a commercial glass container and YAG:Ce nanoparticles phosphor-in-glass (PiG) can be an eco-friendly and low-cost alternative as color converters.



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