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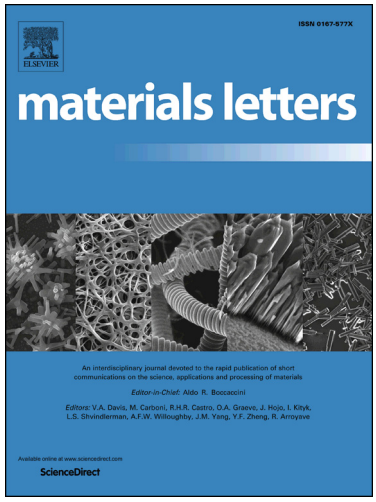

Down-conversion photoluminescence of $ZrO_2:Er^{3+}$ coatings formed by plasma electrolytic oxidation

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Down-conversion photoluminescence of $ZrO_2:Er^{3+}$ coatings formed by plasma electrolytic oxidation

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Abstract

Plasma electrolytic oxidation of zirconium in alkaline solution containing Er_2O_3 powder was used for preparation of $ZrO_2:Er^{3+}$ coatings. Photoluminescence (PL) emission spectra of $ZrO_2:Er^{3+}$ excited by ultraviolet irradiation are composed of broad PL band associated with ZrO_2 host and sharp bands corresponding to *f–f* transitions of Er^{3+}. The strongest green PL emission band of Er^{3+} in the range from 540nm to 580nm is assigned to $^4S_{3/2} \rightarrow {}^4I_{15/2}$ transition. The PL excitation spectra of $ZrO_2:Er^{3+}$ characterize broad band from 250nm to 350nm associated with charge transfer state of Er^{3+} and the series of peaks in the range from 350nm to 530nm which are associated with 4*f* transitions of the Er^{3+} from ground state $^4I_{15/2}$ to higher levels. Obtained results allowed the identification of down-conversion PL mechanism.

Keywords: Plasma electrolytic oxidation; ZrO_2; Er^{3+}; Luminescence; Phosphors.

1. Introduction

ZrO_2 has been widely used as a highly efficient host matrix for trivalent rare-earth ions for the fabrication of photoluminescent materials because of its low phonon frequency (about 470cm^{-1}) as well as excellent chemical, photo-chemical and photo-thermal stability, high refractive index, wide optical band gap, high transparency in the visible and near infrared region, etc. [1,2]. Trivalent rare-earth ions are characterized by a partially filled 4*f* shell that is