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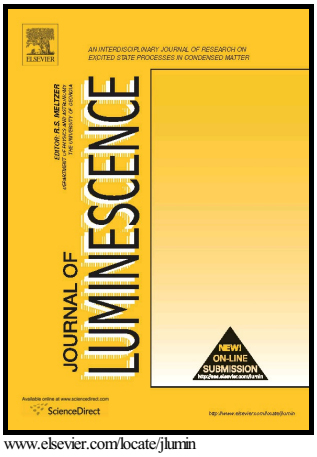
Cai-Feng Wang, Ni Liu, Bo Hu



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IMPROVED WHITE LIGHT EMISSION FROM ZNS:MN/ZNO/GAN CORE-SHELL NANORODS ARRAY

CAI-FENG WANG[1]*, NI LIU[1], BO HU[2]

[1]College of Aeronautical Engineering, Binzhou University, Binzhou 256603, China

[2] Flying College, Binzhou University, Binzhou 256603, China;

*Corresponding author: cfwang_2004@163.com

Abstract: By depositing ZnS:Mn films using PLD technique to coat ZnO nanorods which were grown on GaN substrate using hydrothermal method, high quality ZnS:Mn/ZnO/GaN core-shell nanorods array was prepared. The PL spectrum of ZnS:Mn/ZnO/GaN core-shell array ranges from blue-violet light to red light (400-700 nm). It consists of four luminous bands: UV light at 375 nm originating from the free exciton emission of ZnO, a blue light emission at 450 nm from GaN, an orange light emission at 590 nm mainly from ZnO nanorods and Mn^{2+} in ZnS, and a green light emission at about 530 nm related to ZnS:Mn/ZnO interface. The mechanism of green light emission is analyzed in detail. The color coordinate of ZnS:Mn/ZnO/GaN core-shell array is (0.3347, 0.318), and the color temperature is 5375K, much closer to the standard white light when compared with other systems.

Keywords: ZnS:Mn/ZnO/GaN core-shell nanorods array; White light emission; Photoluminescence; Pulsed laser deposition; Hydrothermal method

1. Introduction

ZnS and ZnO, both are direct broadband gap II-VI compounds, and have been intensively explored as important optoelectronic materials for manufacturing electronic and photonic devices. ZnO nanostructures such as nanorod, nanowire and nanotube, have attracted great attention due to their promising merits of high carrier mobility, excellent photoelectric properties, ease of crystallization. ZnS, especially ZnS:Mn, is also an advantageous material, and it has attracted much research attention in fabricating nanodevices. Duo to their wide, direct band gap and various properties, ZnS:Mn and ZnO have many promising applications, such as fabricating optical devices, light-emitting diodes(LED), field emitters, electroluminescence devices, and light sensor, etc[1].

In recent years, the luminescence of nanostructured semiconductor composites has aroused people's research interest. Therefore, the merits of the two materials might be obtained by combining ZnO and ZnS:Mn nanostructures, and ZnS:Mn/ZnO can be used in novel solar cells and photodetectors. Furthermore, ZnS:Mn/ZnO nanostructures have been proposed to possess improved