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Characteristics of GaAs solar cells with antireflection layer made of porous zinc surfside by glancing angle deposition technique

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Green light emitting diodes based on group-III nitrides still suffer from fairly low performance as compared to shorter advanced photovoltaic technology has been highly demanded on the development of high-efficiency and low-cost solar cells due to the recent global-warming and energy crisis issues. To improve the conversion efficiency (ŋ), antireflection coatings (ARCs) are an essential component. The conventional multilayer ARCs consisting of different materials with different refractive indices also have some drawbacks such as thermal expansion mismatch, diffusion of one material into another and material selection. Recently, multiple studies have been carried out on the same material-based ARCs consisted of a-Si, TiO_2, or ITO employing glancing angle deposition (GLAD) method for solar cell applications. The low refractive index (low-n) film with a high porosity can be obtained by the GLAD due to the self-shadowing effect. In this work, we fabricated the zinc sulfide (ZnS) double-layer antireflection (DLAR) coating consisted of the low-*n*/high-*n* film structure by the GLAD via an e-beam evaporation and investigated its antireflection property. The optical reflectance calculations were also performed using the rigorous coupled-wave analysis (RCWA) method. The considerable enhancement of the conversion efficiency in GaAs single-junction solar cells employed with the ZnS DLAR was demonstrated by obtaining the device characteristics together with the theoretical analysis using the Silvaco ATLAS simulation tool. For the GaAs solar cell with the ZnS DLAR, the decreased solar weighted reflectance (SWR) and the increased ŋ were obtained under AM1.5 g illumination compared to one without an AR layer.

Biography

Jae Su Yu received the Ph.D. degree in Optoelectronic Engineering from Gwangju Institute of Science and Technology, Republic of Korea, in 2002. Since joining in Sept. 2006, he is a tenured Associate Professor in the Department of Electronic and Radio Engineering, Director of the Institute for Laser Engineering, and Kyung Hee Fellow, Kyung Hee University, Republic of Korea.

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