Efficiency improvement of polymer solar cells using down conversion phosphors

박연실, 서동욱, 유재수, 김수영*
중앙대학교
(sooyoungkim@cau.ac.kr*)

We report the effect of the Sr2SiO4:Eu2+ and SrGa2S4:Eu2+ phosphors on the efficiency of polymer solar cells (PSCs). Phosphors are solid, inorganic, crystalline material that can convert wavelength of light. Therefore, it is expected that phosphors could convert the wavelength of light which the active layer can't absorb to the range which the active layer needs. Each phosphor was spin-coated on the backside of the indium tin oxide/glass substrate using poly[methyl methacrylate] with different ratio from 1 wt% to 10 wt%. The UV-vis absorption spectroscopy was used to find out absorption area of active layer. X-ray diffractometer and photoluminescent emission spectroscopy were used to characterize the properties of two phosphors. The short circuit current and power conversion efficiency of the PSCs with Sr2SiO4:Eu2+ phosphor (8.55 mA/cm2 and 3.25 %) and with SrGa2S4:Eu2+ phosphor (9.29 mA/cm2 and 3.3 %) are higher than those of the control device without phosphor (7.605 mA/cm2 and 3.04 %). It is considered that phosphor could tune the wavelength of the incident light to the absorption wavelength of the active layer, improving the efficiency of PSCs.

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