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Characterization of Solar Cells via LED Spectrophotometer with Consideration of Spatial and Spectral Distributions of the LED Light Sources JAEHYEONG LEE, NCSSM, ROB GOURLEY, SIIB, SANGMIN LEE, LSL — Fast and cheap spectral response measurement systems are required in solar cell manufacturing lines in order to produce high quality solar cells. Using LEDs as light sources is the most promising technique. However, since LEDs inherently have 10 - 15 nm spreads in wavelength, the resolution for the wavelength is about 10 times worse than conventional spectrophotometers. In this report, a method to compensate for the wavelength spread of LEDs has been developed. The output power from a solar cell can be expressed as, $P_{out} = \int P_{in}(\lambda) \times \varepsilon(\lambda) d\lambda \cong \int P_{in}(\lambda) \times \sum_{i=0}^{n} a_i \times \lambda^i d\lambda$, where $P_{in}(\lambda)$ is the distribution function of LED light power, $\varepsilon(\lambda)$is the efficiency of a solar cell, λ is the wavelength and a_i is the coefficient of an n^{th} order polynomial approximation of $\varepsilon(\lambda)$. Since 8 different wavelength LEDs were used, the maximum value of $n$is 7. With the same method, quantum efficiency was also approximated. Two different sizes of Si single crystal solar cells were examined with this method. For the larger solar cell, the effect of spatial distribution of LED light intensity was also calibrated. By comparing the data from larger solar cell with existing data sheet, it was confirmed that the solar cell efficiency can be accurately measured by an LED spectrophotometer without assuming monochromatic light sources.

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