Enhancement of the Efficiency in Dye-sensitized Solar Cell by Cylinder Pattern Reflection Layer

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Dye-sensitized solar cells (DSSC) are energy conversion devices that can be manufactured inexpensively without the need of cleanrooms for high vacuum technology, at the expense of relatively modest efficiency. However, DSSC suffer from the problem of short lifetime and low power conversion efficiency. Light harvesting efficiency plays an important role to improve power conversion efficiency (PCE) of the dye-sensitized solar cell (DSSC). Thus, many researchers have employed scatter latter to improve the light harvesting efficiency of DSSC. In this paper, we have proposed a new DSSC structure that employs patterned reflection layer to enhance the light absorption and improve the PCE by using the reflection and diffraction of light phenomena. Optical simulation data were collected through the optical analysis according to various reflection layer. As an optical simulation result, the light harvesting efficiency of cylinder patterned reflection layer is higher than other reflection layer. We have evaluated the cell efficiency for I-V characteristic curves by solar simulator. The DSSC structures with the cylinder patterned reflection layer exhibited higher short circuit current densities and higher PCE (21% enhancement) that those of traditional DSSCs because light that passed through the photoanode was reflected, thereby making it possible to reuse it.

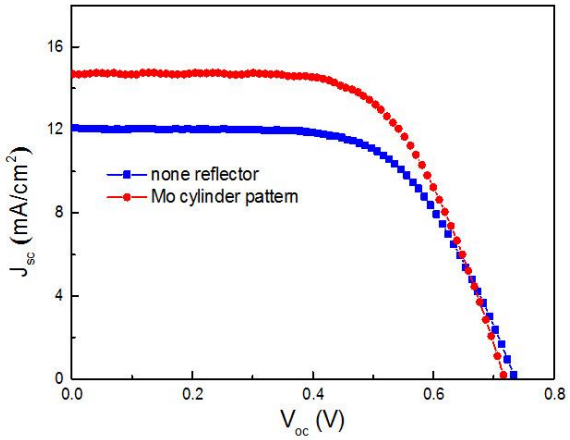

Fig. 1. Current density-voltage characteristics of the DSSC

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References

1. M. Grätzel, *J. Photochem. Photobiol., A*, 164, 3 (2004).
2. J. K. Lee, M. Yang, *Mater. Sci. Eng. B* 17, 1142 (2011).
3. S. C. Choi, E. N. R. Cho, S. M. Lee, Y. W. Kim, D. W. Lee, *Optics Express* 19, 710 (2011).
4. A. Mihi, F. J. López-Alcaraz, H. Miguez, *Appl. Phys. Lett.* 88, 193110 (2006).