Molecular Engineering for Enhancement of Thermal/Light/Water Stability of Organic Dyes for Dye-Sensitized Solar Cells

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DSSCs show the possibility of commercialization and application to building integrated photo voltaic (BIPV) because of their low manufacturing cost, aesthetic qualities and relatively high efficiency at low illumination. However, although short life time and frequent breakdowns are fatal to commercialization, studies on stability have not been systemically researched. Namely, there is still a lack of DSSC commercialization. Therefore, we researched how thermal/light/water stability of dyes depends on the dye molecular structure for commercialization. Changing functional groups and bonds types between donor and π-bridge to enhance the stability and power conversion efficiency, we measured current-voltage (J-V) characteristics basically and tried to test stability of dyes. UV spectra data of systemically modified dyes on TiO_2 films were measured at intervals (0h, 1h, 5h, etc) after being placed in water and acetonitrile (1 : 9 = v : v %) in order to investigate the water stability of dyes. In case of light/heat stability tests, solar cells fabricated with modified dyes were placed on extreme environment (1 Sun and 80^{o}C) for 1000h and then we measured the change of efficiencies and EIS data between 1000h to find out the cause of decrease of the stability and efficiencies. As a result, the thermal/light/water stability was affected by molecular structure of dyes greatly. Therefore, through this research we want to propose a molecular design strategies that suitable to thermal/light/water stability of dyes.