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On the path towards independence from fossil fuels, solar energy is the most promising solution, but it needs a robust and reliable storage system to face its intrinsic fluctuations due to location, day cycle and weather. The integration between harvesting and storage technologies is a must toward clean energy production and it becomes even more appealing considering the possibility of producing electricity not only from direct sunlight but also from diffuse light and indoor illumination.

Dye-sensitized solar cells (DSSC) showed an impressive light-to-energy conversion efficiency when employed under low-light illumination, diffuse solar radiation and indoor light sources. Moreover, low temperature- and atmospheric-pressure-based manufacturing processes make them compatible with roll-to-roll fabrication. This make DSSC an engaging alternative in the landscape of recovering energy from indoor illumination and directly power low-consuming devices (e.g. Internet of Things devices).

For the storage section, electrochemical double layer capacitors (EDLCs) represents a promising solution since they can sustain an incredible number of cycles without appreciably change the capacitance nominal value and they are less sensitive to the voltage output of the harvesting section like a battery. These features perfectly match with the intermittent character of photovoltaic energy production.

Herein we present a DSSC module developed to harvest indoor illumination and directly store it into an EDLC. Six series-connected DSSC are fabricated on the same substrate and the module is integrated with a high-voltage EDLC. The integrated device is characterized under indoor light sources (e.g. LED, fluorescent, halogen lamp) and under mixed natural and artificial light illumination.

References

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