

The Versatility of Mesoscopic Solar Cells

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In our work on solid-state dye-sensitized solar cells (ssDSSC) we have recently [1] shown that copper phenanthroline complexes can act as an efficient hole transporting material. We prepared ssDSCs with the organic dye LEG4 and copper(I/II)-phenanthroline as redox system and achieved power conversion efficiencies of more than 8%.

For perovskite solar cells (PSC) our best performance is presently achieved with a mixed composition of iodide/bromide and methyl ammonium/formamidinium [2]. We will report on our work on optimizing the solar cell efficiency that at present shows a certified efficiency of 21.0%. For cells larger than 1 cm² we recently certified a world record efficiency of 19.6%. With the use of an ALD deposited SnO₂ compact underlayer we have constructed a planar perovskite solar cell with a hysteresis free efficiency of above 18% [3]. Based on this configuration we have in collaboration with the group of Prof. Bernd Rech, Helmholtz Zentrum Berlin, prepared a monolithic Perovskite/Silicon-Heterojunction tandem solar cell with an efficiency above 18% [4], pointing out a promising direction for further improvement of tandem cells using PSCs as one of the constituents. Another possibility for a tandem system has been investigated in collaboration with Prof. Segawa and co-workers in which a spectral split-cell, using a combination of a DSSC cell (with a wideband dye DX3) and a perovskite cell, demonstrated an efficiency of 21.5% [5].

References

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