Planar heterojunction perovskite $CH_3NH_3PbI_{3-x}Cl_x$ solar cell

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Organometallic halide perovskite solar cells are rapidly becoming a promising technology for solar energy conversion[1]. To overcome pinholes problem in $CH_3NH_3PbI_{3-x}Cl_x$ we have been used modified interdiffusion method[2]: on patterned ITO coated glass after careful cleaning aqueous PEDOT:PSS layer was deposited by spin coating and annealing. This layer was covered by mixture of PbI_2 and $PbCl_2$ dissolved in DMF and DMSO mixture by spin coating at a rate 6000 rpm at 65˚C and dried. On top of this layer CH_3NH_3I solution in 2-propanol was spin coated at the same coating regime and annealed at 107˚C for 2 h. After cooling to room temperature system was covered with PCBM dissolved in DCB and annealed in argon atmosphere at 105˚C for 1 h, cooled down and put in vacuum chamber where 50 nm thick C_{60} layer and 60 nm thick Ag electrode were thermally evaporated at pressure 10^{-6} mbar. All photoelectric measurements have been made in the same homemade vacuum cryostat where electrode was deposited at $p \sim 5 \cdot 10^{-7}$ mbar without breaking the vacuum. The spectral dependencies of short circuit photocurrent external quantum efficiency (EQE), fill factor (FF), open circuit voltage (V_{OC}) and power conversion efficiency (PCE) have been investigated in spectral range 370-900 nm, using synhro-detection technique and PC controlled data storage equipment. It was found that FF values increase increasing exciting light quantum energy reaching 85% at 400 nm; also V_{OC} values monotonically increase increasing quantum energy in 780-460 nm spectral range.

References

1. T.Salim, S.Sun, Y.Abe, A.Krishna, A.C.Grimsdale and Y.M.Lam, J.Mater.Chem.A **DOI:** 10.1039/C4TA05226A (2015)
2. Z.Xiao, C.Bi, Y.Shao, Q.Dong, Q.Wang, Y.Yuan, C.Wang, Y.Gao and J.Huang, Energy Environ. Sci. **7**, 2619-2623 (2014)