

Supplementary Information

The relationship between V_{oc} decay measurement and the effect of a blocking layer is explained at Fig. 1S. In the left figure, the blocking layer was placed between the absorber and the FTO bottom electrode. When the light was in the “off” state, the solar cells with 80 nm-thick blocking layers show a decay of V_{oc} in the right figure. The decay curve of the cells prepared using a NCD-blocking layer showed a slow and shallow decrease. This result suggested that the blocking layer prepared using NCD effectively prevented the recombination of electrons and holes. Conversely, in the case of a conventional blocking layer, the decay curve of V_{oc} showed a rapid and deep decrease. This result shows that the effect of the blocking layer was negligible.

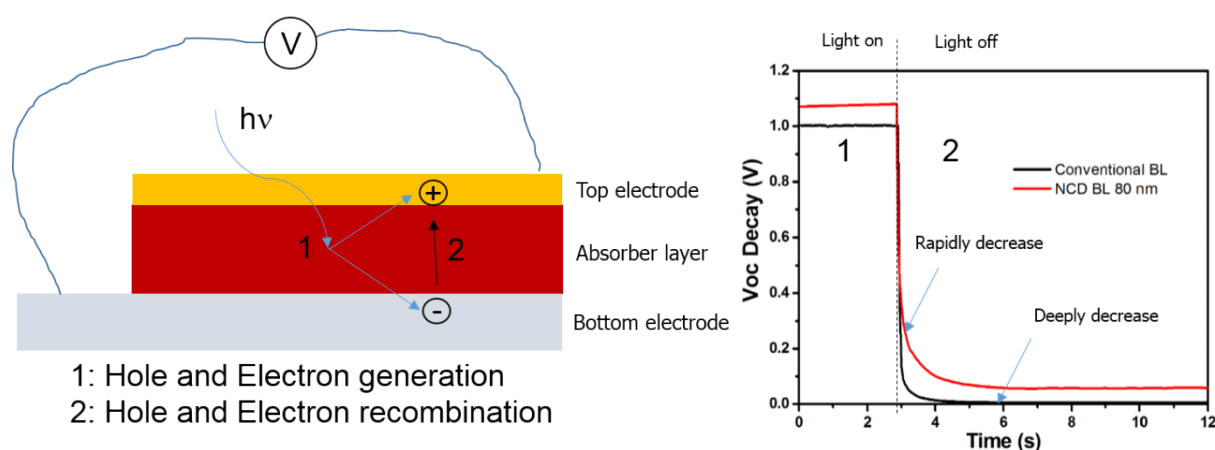


Fig. 1S Schematic diagram of the recombination and generation of the hole-electron (left).

V_{oc} decay of the perovskite solar cells using conventional and NCD-TiO₂ blocking layers (right).