Flexible Photovoltaic Cells Based on Multilayer Transparent Electrodes

Xiaoyang Guo, Ying Lv, Yi Fan, Jie Lin, Xingyuan Liu

State Key Laboratory of Luminescence and Applications, Changchun Institute of Optics, Fine Mechanics and Physics, Chinese Academy of Sciences, Changchun 130033, China
(guoxy@ciomp.ac.cn)

Abstract

Facing the future development trend of flexible and wearable optoelectronic products, transparent electrode, as an important part of optoelectronic devices, has a crucial impact on the future development of optoelectronic industry. As one of the alternative electrodes to traditional ITO electrode, dielectric−metal−dielectric (DMD) multilayer transparent electrodes possess high transmittance, low sheet resistance and excellent bending durability, which have potential applications on flexible organic or perovskite photovoltaic cells.

During the past few years, a series of DMD transparent electrodes have been developed, such as WO_3/Ag/WO_3(WAW) [1], NiO/Ag/NiO(NAN) [2], SnO_2/Ag/SnO_2/Bi_2O_3(SASB) [3], PVK/Ag/PVK(PAP) and PVK/Ag/PEDOT(PAPE) [4], ect.. All these transparent electrodes show excellent photoelectric and bending characteristics. The flexible polymer solar cells based on these DMD electrodes also display competitive device performance and flexiblity.

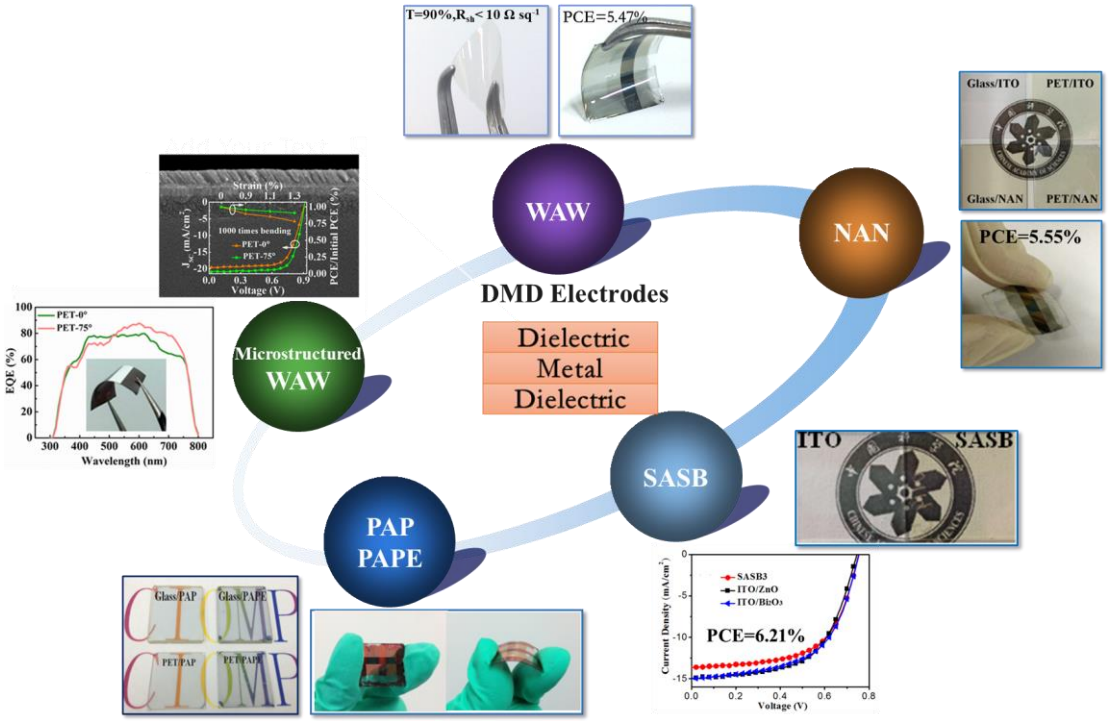

Figure 1: DMD transparent electrodes and photovoltaic cells.

Last year, microstructured WAW multilayer transparent electrodes have been manufactured by the glancing angle deposition method, and employed in the perovskite photovolatic cells (PSCs) [5]. The unique microstructures of the WAW electrode disperse stress under repeated bending and induce smaller grains that suppress the boundary traps or defects formation under plastic deformation, reducing the damage on the perovskite layer, contributing to the enhanced photoelectric and flexibility of device. The optimal device based on the microstructured WAW electrode shows an 10% increase in power conversion efficiency by comparing to the reference device. Simultaneously, the bending stability of the flexible PSCs based on the microstructured WAW electrode has been improved by 16%, which proves the potential applications of DMD electrodes on flexible PSCs.

References

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