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The study on AZO based hybrid transparent electrode and its application in perovskite solar cells

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The presentation will focus on improving the performance of the perovskite solar cells via fabricating novel transparent electrode with superior photoelectrical properties and selecting as well as modifying the electron transport material, and carried out the following works:

(1) A triple-layered transparent conductive film, AZO/Pd/AZO (APA), was deposited via magnetron sputtering on glass substrate at room temperature. The resistivity of APA film annealed in hydrogen atmosphere rapidly decreased. Optical measurements indicated that the optical band gap (E_g) of APA films varies from 3.37 eV to 3.69 eV with adjusting annealing temperature from 200 °C to 500 °C. The very low resistivity of 4.8×10^{-4} Ω cm with a sheet resistance of 45 Ω/sq, a transmittance of 83.2% and a figure of merit value of 3.53×10^{-3} Ω^{-1} were obtained after hydrogen annealing at 400 °C.

(2) ITO/Ag grid/AZO hybrid electrode was used for low-temperature planar perovskite solar cell with the electron transport-layer of ZnO nanoparticles. The results demonstrate that neither a mesoporous scaffold nor any high-temperature processing steps were required and the PCE as high as 13.86% was achieved. ITO/Ag grid/AZO hybrid electrode with the optimized Ag grid of 15×100 μm showed an extremely low sheet resistance of 3.8 Ω/sq and a relatively high transparency of 89.6% at the wavelength of 550 nm. A very high FOM of 8.8×10^{-2} Ω^{-1} was achieved by combining outstanding electrical properties of ITO and excellent optical properties of AZO.