Oxygen diffusion barrier coated on a transparent AZO electrode for dye-sensitized/perovskite solar cells

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Developing thermally stable TCOs which are more conductive and transparent than fluorine-doped tin oxide (FTO) is a promising strategy to increase the efficiency of dye-sensitized or perovskite solar cells. The aluminum-doped zinc oxide (AZO), which is cheap with good TCO properties, is unfortunately unstable above 300 oC in air. The first priority to enhance its thermal stability is to establish mechanisms of electrical deterioration of AZO films at high temperatures. In this study, the insulating aluminum oxide formation at surface of AZO films as well as the decrease of oxygen vacancies at high temperatures turned out to be the reason for the decrease of conductivity. Both AlOx formation and decrease of oxygen vacancies are caused by oxygen adsorption, thus the oxygen diffusion barrier can help prevent these phenomena. Here, ZnF2 and SnO2 thin films were used as a barrier layer. Oxygen barrier/Al-doped zinc oxide double-layered transparent conducting oxides showed enhanced thermal stability and suitable optical properties for the solar cells after the high temperature process in air.