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Ball Milling synthesis and characterization of highly crystalline TiO2-ZnO hybrids for photovoltaic applications

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In this work, Ball Milling is investigated as a viable synthesis method for highly crystalline TiO2-ZnO composites. The composites were verified using various standard techniques. XRD measurements confirmed the presence of hexagonal wurtzite ZnO and tetragonal TiO2 nano particles. Both XRD and transmission electron microscopy show a mean crystallite size between 12.7 and 15.0 nm. The blend compatibility of the two oxides was investigated by varying the molar ratio of ZnO from 0 to 30%. It is apparent that the morphology compatibility of ZnO and TiO2 plays a significant role in the performance of the final device. The composite specific surface area is seen to increase with ZnO doping. UV-Vis measurements show that its band gap decreases from 3.281 to 3.221 eV. UV-vis further demonstrated a red-shift of TZHO absorption band which enhances the ability of hybrids to absorb in the visible wavelength range. Scanning electron microscopy suggests that TiO2 and ZnO are morphologically well-matched, and can be used as the electron transport layer in a blended perovskite solar cell. A maximum efficiency of 8% was measured on the PSC with 30% ZnO with Isc=18.4 mA, Voc=0.69 V, and FF=0.65. This efficiency is comparable for PSCs with the hybrid oxide synthesized using other methods, showing that Ball Milling is also a viable method.

Apply to be considered for a student ; award (Yes / No)?

No

Level for award;(Hons, MSc, PhD, N/A)?

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