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MoO₃ Surface Passivation on TiO₂: An Efficient Approach to Minimize Loss in Fill factor and Maximum Power of Dye Sensitized Solar Cell

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ABSTRACT. The present study demonstrates the possibility for improving the performance of dye sensitized solar cell (DSSC) only by minimizing the loss in fill factor (FF) and maximum power point (P_{MAX}) which can be achieved by passivating the nanocrystalline titanium dioxide (TiO₂) using physical vapor deposited molybdenum trioxide (MoO₃) thin films. The effect of MoO₃ coated TiO₂ on charge carrier transport was examined in resulting DSSCs and observed that ~14 % enhancement in efficiency is possible for 5 minutes passivation of MoO₃ on TiO₂. The physical vapor deposited MoO₃ films were ~ 75 % transparent in the spectral range of 350 nm-800 nm with an optical bandgap of ~3.1 eV. The wide bandgap MoO₃ films facilitate the incoming photons to reach the sensitizing dye to generate excitons. The 14 % enhancement in the performance of DSSC by MoO₃ passivation is observed through improving only the FF and P_{MAX} while it does not contribute anything significantly to current density and open circuit voltage. Electrochemical impedance spectroscopic studies further confirmed these observations through photo-electron lifetime, which remains constant both in the bulk of pristine TiO₂ and MoO₃ passivated TiO_2 and it further confirms the effect of MoO_3 passivation on FF and P_{MAX} in DSSCs.

Key words: defects, MoO₃, charge transport, recombination, solar cell, passivation

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