

### Highly ordered mesoporous structured and partially reduced tungsten oxide counter electrode for Dye sensitized solar cells

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Dye sensitized solar cells (DSCs) have been considered as one of the promising renewable energy technology. Recently, many research have focused on iodine free electrolyte because  $I_3^-/I^-$  electrolyte has corrosive property to metal such silver (Ag) used as current collector and also absorb visible light at  $\sim 430$  nm. Especially, disulfide/thiolate( $T_2/T^-$ ) redox couple electrolytes reported by M. Wang et al. showed PCE of 6.4% based on platinum counter electrode (CE) with promising properties which are negligible absorption in the visible light region and non-corrosive properties. However, the Pt CE has large charge transfer resistance ( $R_{ct}$ ) causing low fill factor and lower efficiency than  $I_3^-/I^-$  based DSCs. In this context, we utilized ordered mesoporous structured and partially reduced tungsten oxide as a efficient CE in  $T_2/T^-$  electrolyte based DSC and showed 79% improvement of PCE than conventional Pt CE which is attributed that synergetic effect combined by Mesoporous structure and partial reduction. We investigated the catalytic activities through cyclic voltammetry (CV) and electrical impedance spectroscopy (EIS) and Tafel Plot.