Synthesis of low cost WC/C nanofiber through electrospinning and application as a Pt free counter electrode for Dye sensitized solar cell

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Dye sensitized solar cell (DSSC) have attracted intense attention and been explosively investigated as a renewable energy device due to its advantages such as easy fabrication and low cost compared with conventional silicon solar cell. Counter electrode (CE), one of the components of DSSC plays a important role in catalyzing a redox reaction of electrolyte to complete a circuit of DSSC. CE with high catalytic activity can reduce internal series resistance, resulting in high Fill Factor (FF). However, conventional platinum (Pt) is expensive and it shows poor catalytic activity in Iodine free electrolyte, especially disulfide/thiolate (T_2/T^-) electrolyte. Accordingly, we developed low cost tungsten carbide/carbon composite nanofiber (WC/C NF) using facile electrospinning technique and compared its catalytic activity with Pt CE in I_3^-/I^- as well as T_2/T^- electrolytes. Due to synergistic effect from the combination of catalytic active WC and conductive carbon within one-dimensional nanofiber structure, WC/C NF CE showed power conversion efficiency (PCE) of 7.8% corresponding to 96% that of Pt in I_3^-/I^- electrolyte. Furthermore, it exhibited higher PCE, which is almost twofold that of Pt in T_2/T^- electrolyte. To confirm the catalytic activity of WC/C nanofiber, we investigated cyclic voltammetry, electrochemical impedance spectroscopy and Tafel Plot.