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Graphitic carbon nitride nanotubes grown on carbon paper for efficient electrocatalytic hydrogen evolution reaction

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The growth population and decreasing source energy have been a challenge in recent years. Among several energy sources, the production of hydrogen from the process water splitting has been interest [1]. Hydrogen reduction reaction (HER) plays an important role in various renewable energy devices, fuel cells. Currently, state-of-the-art HER, catalyst is Pt, but their long-term availability is questionable owing to the scarcity and subsequent high cost. Therefore, substantial efforts have been devoted to develop non-noble transition-metal-based and metal-free electrocatalysts with commensurate performance. Hydrogen production from water using active semiconductor photocatalysts is an attractive solution to increasing energy demand. Recently, graphitic carbon nitride nanotubes (g-C_3N_4 NTs) hase an drawn considerable attention due to their unique and tunable nanostructure, good chemical stability,earth-abundant, high nitrogen content, easy synthesis and conductivity[2,3]. To increase the photocatalytic activity of g-C_3N_4 NTs, carbon paper (CP) have been used to achieve effective photocatalytic for hydrogen production. In this work, g-C_3N_4(NTS) nanocatalyst was synthesized by precursor melamin and $Co(NO_3)_2.6H_2O$.In the next step g-C_3N_4(NTS) used for growing upon CP. The prepared nanocatalyst was characterized using X-ray diffraction (XRD), scanning electron microscopy (SEM) and Attenuated total reflection infrared spectroscopy (ATR-IRS). Several factors that may effect the hydrogen release rate process, including the amount of Co, electrodiposition time were optimized. The electrochemical diagram indicated that the CP-g-C_3N_4(NTS) provides a higher specific activity than g-C_3N_4(NTS) and CP. This study, the CP-g-C_3N_4(NTS) structure is developed as the cost-effective catalytic showing remarkable versatility for HER with high stability and activity , which is originated from increased exposure and accessibility of active sites, improved vectorial electron transport capability and enhanced release of gaseous products.

Keywords: Graphitic carbon nitride nanotubes, carbon paper, Hydrogen evolution reaction

References

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