Electrochemical Evaluation of MoS₂-Cu-RGO as a Catalyst for Hydrogen Evolution in Microbial Electrolysis Cell

Hongyan Dai^{1,*}, Huimin Yang², Zhenhai Liang²

¹ Department of Materials and Chemical Engineering, Taiyuan College, Taiyuan 030032, China

² College of Chemistry and Chemical Engineering, Taiyuan University of Technology, Taiyuan 030024, China

*E-mail: daihongyan12@sina.com

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A series of MoS₂-Cu-RGO composites were synthesized by hydrothermal method, and loaded on the carbon-based electrode. The best MoS₂-Cu-RGO electrode selected through electrochemical tests was applied as the cathode to produce hydrogen in a single-chamber microbial electrolysis cell (MEC). SEM and TEM images showed that most thin MoS₂ sheets vertically grew on the surface of RGO; Cu₂O acted as the bridged absorbent and efficient charge transfer channels between RGO and MoS₂, which exposed more hydrogen evolution active sites and improved the electrical conductivity. Electrochemical tests showed that the optimal mass ratio of (NH₄)₂MoS₄, GO and CuCl₂·2H₂O was 1:1:1.1, and 3 mg/cm² was the optimal load for carbon paper. The average current density, coulombic efficiency, hydrogen recovery efficiency, cathodic hydrogen recovery efficiency, hydrogen production rate, electrical recovery efficiencies and overall energy recovery efficiencies obtained with MoS₂-Cu-RGO cathode MEC were 10.28±0.40 A/m², 92.10±3.53%, 74.69±4.45%, 79.22±3.53%, 0.449±0.027 m³H₂/m³d, 237.68±15.66% and 88.20±5.60%, higher than those obtained with the Pt/C cathode MEC. The MoS₂-Cu-RGO cathode enjoyed good stability and price advantage, which might promote the practical application of MECs.

Keywords: MoS₂-Cu-RGO, carbon-based electrode, microbial electrolysis cell, hydrogen production.

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