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纳米晶碳化钨薄膜的析氢催化性能

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摘要 采用等离子体增强化学气相沉积法制备了具有纳米结构的碳化钨薄膜, 采用XRD、EDS、SEM方法表征了薄膜的表面形貌、化学组成和物相结构. 这种碳化钨纳米晶薄膜具有巨大的电化学比表面积、很好的电催化活性和电化学稳定性. 通过测试和计算表明, 几何面积为1cm^{2}碳化钨薄膜/泡沫镍电极、碳化钨薄膜/镍电极的电化学比表面积分别为83.21和64.13cm2; 该薄膜电极材料的a值为0.422～0.452V, 接近低超电势材料; 析氢交换电流密度为4.02～4.22×10^{-4}A/cm^2; 当超电势为263mV时, 其析氢反应的活化能为45.62～45.77kJ/mol.

关键词 等离子体增强化学气相沉积 碳化钨纳米晶薄膜 电催化 氢析出反应

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Electrocatalytic Activity of Nano-crystalline Tungsten Carbide Thin Film Electrode for Hydrogen Evolution

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Abstract Nano-crystalline tungsten carbide thin films were fabricated on foam nickel and nickel foil substrates by plasma enhanced chemical vapor deposition. The structure and morphology and constitutes of the thin films were token by XRD, SEM, EDS. The real surface area, chemistry stability and electro-catalytic properties for the hydrogen evolution reaction of the films were also investigated. The electrochemical analysis shows that the real surface area of 1cm^2 WC/foam-Ni and WC/Ni films catalysts is 83.21 and 64.13cm^2 respectively. The Tafel parameter a of the thin film electrode for hydrogen evolution is 0.422～0.452V. The hydrogen evolution exchange current density is 4.02～4.22×10^{-4}A/cm^2, When the over-potential is 263mV, the activation energy of hydrogen evolution is 45.62～45.77kJ/mol.

Key words PECVD nano-crystalline tungsten carbide thin film electrocatalysis hydrogen evolution

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