

能源和环境工程

Pd - Ni双金属复合物修饰泡沫镍电极对水中4-氯酚的电化学脱氯

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收稿日期 2008-12-22 修回日期 2009-2-10 网络版发布日期 2009-6-17 接受日期

摘要 以Pd - Ni双金属复合物修饰泡沫镍电极 (Pd - Ni/Ni) 为阴极, 对水中4 - 氯酚 (4 - CP) 进行了电催化脱氯。Pd - Ni双金属颗粒直径大约为50 - 100nm且均匀地分散在泡沫镍基体上。高效液相色谱 (HPLC) 分析结果表明 Pd - Ni/Ni电极比Pd/Ni或Ni/Ni电极具有更高的催化效率, 而苯酚是主要的脱氯产物。增大4 - CP初始浓度和升高溶液温度均能使电流效率增大, 而还原电流的增大则使电流效率减小。在表观电流密度2.500 mA/cm²、溶液温度15 ° C、4 - CP初始浓度1 mmol · L⁻¹时, 4 - CP脱氯效率可达82%。另外, 根据Pd - Ni/Ni, Pd/Ni和Ni/Ni三种电极的电化学阻抗谱的差异以及它们在不同电流条件下的脱氯效率, 推断得到不同极化条件下的速率控制步骤。

关键词

[钯镍复合物](#) [电催化](#) [4-氯酚](#) [脱氯](#)

分类号

Electrochemical dechlorination of 4-chlorophenol in aqueous solution using a palladium-nickel bimetallic composite catalyst supported on nickel foam

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Abstract

The electrocatalytic dechlorination of 4-chlorophenol (4-CP) in aqueous solution was studied by using a palladium-nickel bimetallic composite catalyst deposited on nickel foam (Pd-Ni/Ni foam) as the cathode. The Pd-Ni composite particles with a diameter of less than 50 nm were finely dispersed on the Ni foam surface. The Pd-Ni/Ni foam electrode exhibited higher dechlorination efficiency than single Pd or Ni supported on Ni foam electrodes. High-performance liquid chromatography analysis verified that phenol was the main dechlorination product. For an applied current of 20 mA, a bulk solution temperature of 15 °C, and an initial 4-CP concentration of 1 mmol · L⁻¹, dechlorination efficiency of 82% was observed. Based on electrochemical impedance spectroscopic results and the current efficiency of 4-CP dechlorination at different applied currents on various electrodes, the authors determined the rate-limiting step under various polarization conditions in the experiments.

Key words

[Pd-Ni composite](#) [electrocatalysis](#) [4-chlorophenol](#) [dechlorination](#)

DOI:

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