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研究论文

电化学方法获得具有表面增强拉曼活性镍电极的研究

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摘要

利用纯电化学手段获得了具有较强表面增强拉曼活性的镍电极, 改进了原有的镍电极表面预处理方法. 结果表明, 在0.5 mol/L的$NaClO_4$溶液中, 结合电化学阶跃技术和循环伏安技术, 可以得到合适的粗糙镍电极; 同时, 还得到了探针分子吡啶在该粗糙镍电极表面随电极电位变化的表面增强拉曼光谱(SERS), 此时谱峰强度获得了极大的增强; 还研究了粗糙镍电极的扫描电子显微镜(SEM)图像, 并估算出其SERS增强因子约为10^4, 此结果比以前的镍电极表面粗糙方法所能达到的增强因子高一个数量级.

关键词 镍电极 电化学粗糙 表面增强拉曼光谱 吡啶 表面增强因子

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Surface-enhanced Raman Spectroscopic Activity on Bare Nickel Electrode Roughened by Electrochemical Method

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Abstract Surface-enhanced Raman scattering(SERS) active Nickel electrode was roughened by electrochemical potential step technique combined with cyclic voltammetry(CV) in 0.5 mol/L $NaClO_4$ solution. It could be seen from the SEM images that uniform and nanometer level Ni particles which might induce an optimal SERS activity were produced on the Ni surface. Meanwhile, the studies of potential-dependent SERS of pyridine revealed that pyridine was interacted with Ni surface *via* N atom vertically because of the observation of in-plane vibration mode and Ni—N stretching vibration. Furthermore, the roughness factor of the Ni electrode was measured by comparing the differential capacitance of roughened surface with mechanical polished smooth surface, and thus the surface-enhancement factor(SEF) of the roughened Ni electrode was calculated in the range of about four orders, and it was one to two orders larger than that reported by the previous surface pretreatments.

Key words Ni electrode; Roughening via electrochemical method; Surface-enhanced Raman spectroscopy(SERS); Pyridine; Surface-enhancement factor

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