化学学报 2006 17 (17): 1812～1816 ISSN: 0567-7351 CN: 31-1320/06

研究论文

扫描电化学显微镜沉积六氰合铁酸盐微阵及其催化活性成像

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收稿日期 2005-9-26 修回日期 2006-3-9 网络版发布日期 2006-9-8 接受日期 2006-5-11

摘要 采用扫描电化学显微技术在玻碳电极表面沉积出$K_2Cu[Fe(CN)_6]$和$K_2Fe[Fe(CN)_6]$微阵, 并对所得的微阵结构进行了可视化表征. 铜微电极和镀铁铂微电极阳极化产生金属离子, 然后与玻碳电极(基底电极)上还原产生的$[Fe(CN)_6]^{4-}$在微区生成六氰合铁酸盐沉淀, 操纵探针以跳跃沉积方式可以得到沉淀的点阵结构. 通过改变$K_3[Fe(CN)_6]$的浓度和沉积时间可以调整沉淀斑的直径和厚度. 扫描电化学显微镜成像表明微阵结构对多巴胺的氧化和过氧化氢的还原有明显的电催化作用.

关键词 扫描电化学显微镜 微阵列 六氰合铁酸盐 多巴胺 过氧化氢 成像

分类号

Deposition and Catalytic Activity Imaging of Metal Hexacyanoferrate Microarray by Scanning Electrochemical Microscopy

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Abstract Scanning electrochemical microscopy (SECM) was used to deposit and visually characterize localized precipitate microarrays of copper hexacyanoferrate and iron hexacyanoferrate on glassy carbon electrode (GCE), respectively. Dissolution of a sacrificial Cu microelectrode and stripping of Fe pre-deposited on a platinum microelectrode generated relevant metal cations in the gap between the microelectrode and the GCE, which precipitated some $[Fe(CN)_6]^{4-}$ anions that were generated simultaneously by reduction of $[Fe(CN)_6]^{3-}$ at the GCE. By moving the microelectrode in the “skip-dip deposition” mode, precipitate-dot microarrays of copper hexacyanoferrate (CuHCF) and iron hexacyanoferrate (FeHCF), typically of about 25 μm diameter for each dot, was fabricated, respectively. The diameter and thickness of disk-shaped precipitate dot could be modified by changing the concentration of $K_3[Fe(CN)_6]$ or the deposition time. The deposited metal hexacyanoferrate microstructures showed catalytic activity for the oxidation of dopamine and the reduction of hydrogen peroxide, respectively, which were characterized visually by SECM.

Key words scanning electrochemical microscopy microarray hexacyanoferrate dopamine hydrogen peroxide imaging

DOI:

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