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论文

光化学合成Au核@Pd壳复合纳米粒子及其表征

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摘要:

在PEG-丙酮溶液体系中, 采用紫外光辐射还原Au(III), Pd(II)离子混合物和以Au晶种为核、紫外光辐射还原Pd(II)使其沉积在Au晶种表面上这两种方法, 合成了Au核@Pd壳复合纳米粒子. 通过改变Au(III)离子或Au晶种对Pd(II)离子的摩尔比调节复合粒子的尺寸和Pd壳厚度, 分别获得了直径范围为5.6~4.6 nm和4.6~6.2 nm的复合粒子. 利用UV-Vis吸收光谱、TEM、HR-TEM和XPS等表征手段, 证明了合成的纳米粒子为核-壳复合结构. 研究了Au@Pd纳米粒子的直径随溶液中Au(III)/Pd(II)摩尔比的变化而变化的规律; 对Au核向Pd壳的供电子作用以及复合粒子的光化学形成机理进行了讨论.

关键词: Au核@Pd壳; 复合纳米结构; 光化学合成; 表征; *d*电子

Photochemical Synthesis and Characterization of Gold@Palladium Core-Shell Composite Nanoparticles

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Abstract:

The combined gold and palladium bimetallic nanoparticles were received significant attention because of their special catalytic properties and Surface-enhanced Raman scatterings. In this paper, we report a new synthesis of Au@Pd core-shell composite nanoparticles by the photochemical method. The bimetallic nanoparticles with an Au core@Pd shell composite structure were synthesized in PEG-acetone solution by UV photochemical reduction, using both approaches of simultaneous reduction of Au(III) and Pd(II) ions and Au seeding growth in the presence of Pd(II). The bimetallic nanoparticles sizes obtained by two approaches are between 5.6—4.6 and 4.6—6.2 nm, respectively. The sizes of composite particles and the thickness of the palladium shell can be tuned by varying molar ratio of Au(III) or Au(0) and Pd(II). Based on the characterizations by UV-Vis, XPS, TEM and HR-TEM, an Au core@Pd shell nanostructure was confirmed and a special changing tendency of the composite particle size with a changing of Au: Pd molar ratio was found. The effect of the Pd shell gaining *d*-electrons from the Au core and the mechanism of forming Au core@Pd shell nanostructure were discussed.

Keywords: Au core@Pd shell; Composite nanostructure; Photochemical synthesis; Characterization; *d*-Electron

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