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研究论文

CoO改性TiO_2光催化从水析氢光电化学行为研究

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摘要 评价了不同Co担载量的CoO-TiO_2系列光催化剂在无氧条件下光催化重整乙醇水溶液反应中析氢性能, 并利用连续瞬间电流-时间响应和循环伏安法等电化学方法, 重点考察了不同Co担载量光催化剂在紫外和可见光光照条件下电流响应强度和起始响应速率的差别, 以及暗态和光照条件下光催化析氢电位变化等光电化学行为. 实验结果表明, 适当量CoO的改性能够显著地提高TiO_2光催化析氢性能, 表现出了良好的稳定性, 最佳担载量为0.4% Co, 将产氢速率由原来的2.9×10^{-3} mL•h^{-1}提高到了2.85×10^{-1} mL•h^{-1}, 提高了近2个数量级. 光电化学行为研究表明, 紫外光照射时CoO改性明显增强了TiO_2的光电流响应强度, 其相对大小顺序为: 3.0% Co＞0.4% Co＞0.0% Co, 但光电流起始响应速度随着担载量的增加有所下降, 其相对大小顺序是: 0.0% Co≈0.4% Co＞3.0% Co. 利用可见光源照射时, 除光电流响应强度总体下降, 光电流响应强度的相对大小顺序为0.4% Co＞0.0% Co＞3.0% Co, 而光电流起始响应速度十分接近.

关键词 光催化 光电化学 CoO-TiO_2 制氢

分类号

Photoelectrochemical Performance of CoO-loaded TiO_2 Photocatalysts for Hydrogen Generation from Water

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Abstract This paper reports the investigations on the preparation and hydrogen-evolving performance of CoO modified-TiO_2 photocatalysts, and the photoelectrochemical performance with the methods of successive sudden photocurrent-time and cyclic voltammetry. The differences between CoO modified and pure TiO_2 photocatalysts on intensity of photocurrent response, starting-response speed and hydrogen-evolving photopotential were discussed in detail. The results showed that an appropriate amount of CoO loading could obviously enhance the hydrogen generation rate from water with a satisfied stability during experimental period. And the optimum loading content of Co was 0.4%. The hydrogen-evolving rate increased from 2.9×10^{-3} mL•h^{-1} of pure TiO_2 to 2.85×10^{-1} mL•h^{-1} of CoO-TiO_2 photocatalyst with 0.4% Co content (*ca*. two order of magnitude). The results of the photoelectrochemical performance under a UV light illuminating condition showed that the CoO modification on the TiO_2 photocatalyst enhanced the photocurrent response intensity in an order of 3.0% Co＞0.4% Co＞0.0% Co. The photocurrent starting-response speed of the higher CoO modified-TiO_2 photocatalyst decreased with an order of 3.0% Co＜0.4% Co≈0.0% Co. But on the other hand, under a visible light illuminating condition, the value order of intensity of photocurrent response was changed to be 0.4% Co＞0.0% Co＞3.0% Co, and the photocurrent starting-response speed was almost the same for studied samples.

Key words photocatalysis photoelectrochemistry CoO modified TiO_2 hydrogen production

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