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ZnO纳米粒子的表面光电压谱和光催化性能

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摘要 采用焙烧前驱物碱式碳酸锌的方法制备了不同粒径的ZnO纳米粒子，而用粒径 最小的作为光催化剂，通过光还原过程分别得了贵金属质量分数为0.5%和0.75%的 Pd/ZnO或Ag/ZnO复合纳米粒子。利用XRD，TEM，XPS，SPS和EFISPS等测试技术对样 品进行了表征，
并通过光催化氧化气相正庚烷评估了样品的光催化活性，考察了微
晶尺寸和贵金属Pd或Ag的沉积对ZnO纳米粒子表面光电压信号以及光催化活性的影 响，
探讨了样品表面光电压谱与其光催化活性的关系，说明了可以通过表面光电压
谱的测试来初步地评估纳米粒子的光催化活性。结果表明：随着ZnO纳米微晶尺寸 的减小，
其SPS信号强度逐渐变弱，而光催化活性逐渐升高；沉积适量的贵金属Pd 或Ag后，
ZnO纳米粒子的SPS信号强度明显下降，而其光催化活性却有所升高。此外 ，
对ZnO纳米粒子光催化剂的失活机理进行了分析。

关键词 氧化锌 纳米相材料 光催化 氧化 正庚烷 催化剂生活

分类号 0643

Surface Photovoltage Spectrum and Photocatalytic Performance of ZnO Nanoparticles

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Abstract ZnO nanoparticles with different size were prepared by calcining the precursor, zinc carbonate hydroxide, at different temperature, and Pd/ZnO or Ag/ZnO composite nanoparticles with the noble metal content of w = 0.5% and 0.75% were obtained by photoreduction method using the smallest ZnO nanoparticles as photocatalysts. The as-prepared samples were also characterized by the techniques such as XRD, TEM, XPS, SPS and EFISPS, and their photocatalytic activity was evaluated by the photocatalytic degradation of gas phase n-heptane. The effects of the crystallite size and the deposit of noble Pd or Ag on the surface photovoltage responses and photocatalytic activity of ZnO nanaparticles were investigated, and the relations between the surface photovoltage spectrum and photocatalytic activity were discussed. It could be concluded that the photocatalytic activity of nanoparticles could be preliminarily evaluated by the measurement of their SPS. The results indicate that the intensity of SPS signal of ZnO nanoparticles decreases with decreasing size, while the photoactalytic activity increases; the intensity of SPS signal of ZnO nanoparticles decreases remarkably after depositing the appropriate noble metal on their surface, while the photocatalytic activity increases. In addition, the deactivity mechanism f the photocatalyst of ZnO nanoparticles was also analysed.

Key words ZINC OXIDE NANOPHASE MATERIALS PHOTOCATALYSIS OXIDATION HEPTANE CATALYST DEACTIVATION

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