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ZnS柱撑高岭石-蒙脱石混层矿物纳米复合材料的制备及其光降解伊红-B的研究

The synthesis of ZnS pillared kaolinite-montmorillonite nanocomposites: highly efficient catalyst for degradation of eosin-B

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中文关键词：ZnS 高岭石-蒙脱石混层矿物 柱撑 光降解 伊红-B

英文关键词：ZnS kaolinite-montmorillonite pillared degradation eosin-B

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杨浩文 李金洪 赵文婷 苗世顶

中国地质大学材料科学与工程学院 北京100083(杨浩文，李金洪，赵文婷)
，中国科学院化学研究所分子科学中心 北京100080(苗世顶)

中文摘要：

以硫尿和乙酸锌为前驱物,通过离子交换和溶液热反应的方法在有机高岭石蒙脱石混层矿物(高蒙混层矿物)层间原位合成了ZnS纳米粒子,得到ZnS柱撑高岭石蒙脱石混层矿物纳米复合材料。X射线粉末衍射分析(XRD)表明高蒙混层矿物的d001从原来的0.98nm被柱撑到1.95nm,表明层间被插入了直径小于1nm的ZnS纳米颗粒。扫描电镜(SEM)观察发现,原高蒙混层矿物的有序片层结构部分被破坏,在被剥离的片层上面均匀覆盖了ZnS颗粒聚集体,粒径在25nm左右。透射电镜(TEM)显示,ZnS颗粒聚集体是由3～5nm的颗粒堆积而成,夹杂在被剥离的高蒙混层矿物层中。选区电子衍射(SAED)和能量散射谱(EDS)测定表明形成的ZnS属于六方晶系,结晶度较低。光降解伊红_B(eosion_B)实验表明该纳米复合物具有极高的反应活性,紫外可见吸收光谱(UV_Vis)跟踪反应历程,表明降解过程中没有其他中间产物生成,20min之内降解率达到99.1%。本方法制备的ZnS柱撑高蒙混层矿物纳米复合材料与前人制备的ZnS纳米粒子相比具有更高的催化活性,方法更简单,原料较便宜,可重复利用。

英文摘要：

ZnS pillared kaolinite_montmorillonite (ZnS-PKM) nanocomposite was successfully prepared in situ via the ion exchange and solvothermal process of a complex precursor of thiourea and Zn (CH3COO)2 at the molar ratio of 2∶1 at 170℃ for 4 h. XRD result shows that the d001 of kaolinite-montmorillonite (KM) is pillared to 1.95 nm from 0.98 nm, which is due to the accommodation of ZnS in the gallery of KM. SEM images illustrate that the uniformly distributed ZnS agglomeration exists on the partially exfoliated KM layers, and TEM verifies that the agglomerated ZnS (～25 nm) is stacked by ZnS subparticles (3～5 nm), which is intercalated in the layers of KM. SAED and EDS confirm that the particles are of hexagonal ZnS with low crystallization. Photo degradation of eosin-B was performed to test the catalytic activity of the prepared ZnS-PKM. UV-Vis absorption spectrum tracking the course of the degradation reaction shows that eosin-B is demineralized in 20min without the formation of new pollutant, and its activity is much higher than activities reported ZnS nanoparticles in references. The probable mechanism lies in the protection of ZnS nanoparticles by the layers of KM from agglomeration, which leads to the possibility of the reuse of ZnS-PKM.

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