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纳米 WS_2 润滑晶体的制备与量子尺寸效应

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摘 要: 纳米 WS_2 润滑晶体是一种性能优良的新型固体润滑材料. 作者介绍了一种用机械-物理固相反应装置制备纳米 WS_2 润滑晶体的新方法; 用XRD对 WS_2 纳米晶体进行了物相分析; 用ESCALAB-MK II型电子能谱仪分析了不同粒径的试样W $4f_{7/2}$, S $2p_{3/2}$ 电子结合能的变化, 并对50 nm和10 nm粒径的S-W-S纳米簇团的S $2p_{3/2}$ 电子能谱结构进行谱图拟合. 分析结果表明: XRD图样显示为 WS_2 单相; 在S-W-S纳米簇团中存在显著的量子尺寸效应, 该效应强化了硫原子电子壳层间的轨道杂化, 使纳米级的 WS_2 润滑晶体形成了1个没有悬键的、化学性能稳定的中空球体, 在润滑过程中, 这种结构可使体系保持较强的化学稳定性, 能耗降低.

关键字: WS_2 ; 润滑晶体; 纳米簇团; 量子尺寸效应

Preparation and quantum size effect of nano WS_2 lubricating crystal

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Abstract: Nano WS_2 crystal is a kind of solid lubrication material with excellent lubrication performance. This paper reports a new method of preparing nano WS_2 lubricating crystal using equipment of Mechanical-physical Solid State Reaction Methods (MPSSRM). The phase analyses of nano WS_2 lubricating crystal were made in the experiment of XRD. The shift of binding energies from W $4f_{7/2}$ and S $2p_{3/2}$ electrons for specimens of different diameters was investigated with ESCAL-AB-MK II, and the spectra fitting analysis for S $2p_{3/2}$ electron in S-W-S cluster of diameters 50 nm and 10 nm were performed. The results show that the diffraction patterns for WS_2 single phase were observed; the pronounced quantum size effect exists in S-W-S nano clusters, and it enhances the hybridization of different electronic shell orbits and formed a closed hollow spherical structure without any dangling bond. In the lubricating process, such a system can maintain its chemical stability and decrease energy dissipation.

Key words: WS_2 ; lubricating crystal; nano cluster; quantum size effect

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