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直流电弧等离子体制备NiO包覆Ni纳米颗粒

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摘 要： 采用直流电弧等离子体技术制备NiO包覆Ni纳米颗粒，对初产物经过钝化处理得到有氧化膜保护的NiO包覆Ni纳米颗粒。采用高分辨透射电子显微镜(HRTEM)、X射线衍射(XRD)、透射电子显微镜(TEM)、选区电子衍射(SAED)、热重和差示扫描量热分析仪(TGA/DSC)以及傅里叶变换红外光谱 (FTIR)等手段对试样的成分、表面组成、形貌、晶体结构、粒度、红外吸收性能和氧化特性进行了分析。结果表明：经过表面钝化处理的NiO包覆Ni纳米颗粒具有明显的核-壳结构，内核为纳米Ni，外壳为NiO氧化物；颗粒呈球形，粒度均匀，分散性良好，粒径分布在20~70 nm范围，平均粒径为44 nm，壳层氧化膜的厚度为5~8 nm；壳核结构可防止纳米Ni颗粒的进一步氧化和团聚，且使红外吸收峰发生蓝移。

关键字： NiO包覆；纳米颗粒；核-壳结构；钝化；氧化特性

Preparation of NiO encapsulated Ni nanoparticles by direct current arc plasma method

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Abstract: The NiO encapsulated Ni nanoparticles were prepared by direct current (DC) arc plasma method and subsequently passivation. The chemical composition, morphology, crystal microstructure, particle size, infrared spectra properties and oxidization resistance of the product were analyzed using the high-resolution transmission electron microscopy (HRTEM), X-ray diffractometry (XRD), transmission electron microscopy (TEM), corresponding selected-area electron diffractometry (SAED), thermogravimetric analyzer (TGA) differential scanning calorimeter (DSC) and Fourier transform infrared spectrum (FTIR). The results show that the NiO encapsulated Ni nanoparticles have clear core-shell structure. The

core consists of Ni particles, while the shell consists of NiO. The samples are homogeneously distributed with spherical shape and well dispersed, the particle sizes distribute from 20 to 70 nm with average particle size of about 44 nm, and the thickness of the shell is 5−8 nm. The core-shell structure can prevent Ni nanopartictes from oxidation and agglomeration, and the infrared absorption band show blue-shifts.

Key words: NiO encapsulated; nanoparticles; core-shell structure; passivation; oxidization resistance