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超临界流体干燥法(SCFD)制备纳米级铜粉

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摘要: 采用均相溶液化学还原法与超临界流体干燥法相结合的组合技术, 制备了高纯度、高分散性、高抗氧化性的立方晶系纳米级铜粉。通过考察反应体系pH值、反应物配比、无水硫酸铜浓度、反应温度、分散剂对反应速度及产物粒径的影响, 得出最佳工艺条件是: pH值为2, 无水硫酸铜与次亚磷酸钠的摩尔比为1:1.3, 无水硫酸铜浓度为0.2 mol/L, 采用复合非离子型分散剂, 反应温度为50 °C, 反应时间为2 h。经超临界流体干燥制得的纳米铜粉用IR、TEM、XRD进行了表征。结果表明, 粉体颗粒为球形, 粒径约为25 nm; 与普通干燥法比较, 超临界流体干燥法实现了粉体干燥与表面改性一步完成。最后, 讨论了纳米铜粉对润滑油摩擦学性能的影响。

关键字: 超临界流体干燥法; 纳米铜粉; 化学还原法; 摩擦学性能

Preparation of nano sized copper powder by supercritical drying technique

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Abstract: High stable and dispersive nanosized copper particles with spherical shape and average size of 25 nm were produced by combining the chemical reduction method with supercritical fluid drying technique. The optimum process conditions selected by test was found as follows: pH value is 2, the molar ratio of CuSO_4 to NaH_2PO_2 is 1.3, the concentration of CuSO_4 is 0.2 mol/L, reaction temperature is 50 °C, reaction time is 2 h, using multiplex non-ionic dispersant. The copper powders gotten at the best conditions were characterized by transmission electron microscopy, X-ray powder diffraction and infrared ray microscopy. Moreover, the tribology property of lubricating oil containing the nanocopper powder was also discussed.

Key words: supercritical fluid drying technique; nanosized copper; chemical reduction; tribology

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