岩矿测试
ROCK AND MINERAL ANALYSIS
中文核心期刊

文章摘要

燕娜,赵生国,赵伟,郑红文.微波消解-电感耦合等离子体质谱测定铜精矿中7种稀有金属元素[J].岩矿测试,2014,33(2):197~202

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Determination of Seven Rare Metal Elements in Copper Concentrates by Inductively Coupled Plasma-Mass Spectrometry Combined with Microwave Digestion

投稿时间： 2013-08-09 最后修改时间： 2013-09-04

DOI：

中文关键词： 铜精矿 稀有金属元素 微波消解 电感耦合等离子体质谱法

英文关键词：copper concentrates rare elements microwave digestion Inductively Coupled Plasma-Mass Spectrometry

基金项目：国家质检总局科研项目“进出口含镍原料元素普查及相关检测技术研究”（2013IK001）

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中文摘要：

准确快速测定铜精矿中7种稀有金属元素（镓铟锗硒碲铊镧）的分布情况对于铜精矿的综合利用及减少技术性贸易壁垒等方面具有重要意义，因锗和铊等目标元素含量低至10^{-7}级，要求分析方法具有高灵敏度。本文应用微波消解-电感耦合等离子体质谱方法实现了7种稀有金属元素的快速准确测定。以盐酸-硝酸混合酸（体积比3：2）作为样品的微波消解试剂，选取合适的分析质量、调谐仪器及数学校正方程等三种方式消除质谱干扰。在优化的实验条件下，目标元素加标回收率为80.2%~123.3%，相对标准偏差小于13.4%。硒的检出限为1.3 mg/kg，另外6种目标元素的检出限均低于0.08 mg/kg。本法目标元素的检出限均低于电感耦合等离子体发射光谱或原子吸收光谱法测定相应元素的检出限。该方法降低了试剂空白，简化了操作流程，提高了分析灵敏度，实现了铜精矿目标元素的同时分析。

英文摘要：

Accurate and rapid determination of the distribution of seven rare metal elements (germanium, indium, gallium, selenium, tellurium, thallium and lanthanum) in copper concentrates plays an important role in the comprehensive utilization and reduction of technical barriers in transaction. However, the low content of target elements, for example, the content of germanium and thallium is as low as 10^{-7}, requires a highly sensitive analytical method. Microwave digestion together with Inductively Coupled Plasma-Mass Spectrometry (ICP-MS) was adopted to achieve rapid and accurate determination of seven rare elements. Hydrochloric acid-nitric acid mixture (volume ratio was 3 to 2) was used as the microwave digestion reagent of copper concentrates. By selecting appropriate analytical quality, tuning the instrument and utilizing mathematical calibration equations, it was possible to eliminate spectral interferences. Under optimal conditions, the target element recoveries ranged from 80.2% to 123.3% and relative standard deviation was less than 13.4%. The detection limits of target elements were below 0.08 mg/kg while that of selenium

was 1.3 mg/kg. To avoid spectral interferences, the low natural abundance ^{82}Se was selected as the analytical mass of selenium. The detection limits of target elements of the proposed method were much lower than those using Inductively Coupled Plasma-Atomic Emission Spectroscopy or Atomic Absorption Spectrometry. Simultaneous determination of the target element in bulk copper concentrates was achieved by the proposed method by reducing the reagent blank, simplifying operational processes, and improving analytical sensitivity.

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