

论文

基于X射线衍射仪的X光晶体本征参量的标定

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摘要:

X光晶体本征参量的实验标定是准确鉴定X光晶体种类和品质,研制各种类型晶体谱仪,X光线谱定量测量和高分辨X光单能成像的基础.基于X射线衍射仪,通过制作平面晶体样品架,采取控制X射线管电源、滤波片选取和厚度控制等措施,极大地抑制了Cu-K β 及韧致辐射,使X射线管光源Cu-K α 单能化,提出了用滤片作为光源单能化的判据.对X光线谱测量中常用的X光分光晶体季戊四醇的晶格常量 $2d$ 和Cu-K α 能点的积分衍射效率 R_c 进行了标定方法研究,其标定值分别为 $(0.874\ 25\pm 0.000\ 42)\text{nm}$ 和 $(1.759\pm 0.024)\times 10^{-4}\text{Rad}$.基于X射线衍射仪的X光晶体本征参量的精密实验标定方法既快速高效,且十分方便和灵活.通过更换衍射仪的X射线管靶材,采取类似方法,可以标定其它能点的晶格积分衍射效率,可为X光晶体的本征参量库提供更多的标定数据.

关键词: 标定方法 X光晶体 本征参量 X射线衍射仪

Calibration of Characteristic Parameters for X-ray Plane Crystal on the Automatic X-ray Diffractometer

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Abstract:

X-ray crystal characteristic parameters are the bases of identification of X-ray crystal species and class, kinds of X-ray crystal spectrometer fabrication, X-ray lines intensity quantitative measurement and X-ray monochromatic image diagnosis. On the automatic X-ray diffractometer (XRD), based on stability and precision control of θ and 2θ goniometer, special plane crystal holder was made. Bremsstrahlung and Cu-K α line were attenuated for 5 orders by 40 μm -thick Nickel filter, X-ray sources was to be Cu-K α monochromatic source, and transmission power of filter was the criterion of Cu-K α monochromatic source. For X-ray Pentaerythritol(002) plane crystal of Crystal lattice ($2d$) and integral reflective coefficient (R_c) of Cu-K α energy were calibrated, there are $2d=(0.87\ 425\pm 0.00\ 042)\text{nm}$, $R_c=(1.759\pm 0.024)\times 10^{-4}\text{Rad}$ respectively. This kind of experimental method is efficient and convenient on XRD in common laboratory. On XRD, other monochromatic X-ray sources can be obtained by changing the material of X-ray tube, and integral reflective coefficient of different energy will be obtained by the same way.

Keywords: Calibration X-ray crystal Characteristic parameter X-ray diffractometer

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