

论文

小型快速扫描近红外光谱仪的研制

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摘要:

介绍了一种基于Czerny-Turner光路结构并采用谐波电机直接驱动光栅的小型快速近红外光谱仪的设计、仿真及初步测试结果.为了减小多次反射及衍射产生的杂散光,运用Cary理论进行光路布局与设计,使用光学软件TracePro进行了仿真,结果显示改进之后的结构有效抑制了系统的杂散光.为了减小体积并提高扫描光谱速度,采用谐波电机直接驱动光栅代替传统的电机传动正弦丝杆再驱动光栅的结构,在近红外光波段对样机性能进行了初步测试,并对葡萄糖水溶液进行了定性测量.初步测试结果显示:波长范围800~1 500 nm,扫描速度达到75 nm/s,光谱分辨率6 nm,波长准确性±0.5 nm,重复性≤1 nm,信噪比为1 000 : 3,吸光度重复性≤0.008 AU,基线稳定性0.000 5 A/h,简单葡萄糖水溶液的定性测试结果比较清晰地反映了样品的特性.

关键词: 近红外光谱仪 Cary原理 Czerny-Turner结构 谐波电机 TracePro

Design of a Small Rapid Scanning Near Infrared Spectroscopy

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Abstract:

The design method, simulation and test results of a small rapid scanning type near-infrared spectrometer (NIR) based on improved Czerny-Turner optical structure were presented. To reduce the stray light caused by multiple diffractions and multiple reflections, the optical structure was arranged and optimized by the Cary principle. The simulation and analysis result using optical software TracePro were also presented. Stray light was suppressed in the improved structure effectively. On the other hand, in order to increase the scanning speed, a harmonic motor was used to drive the grating directly instead of the traditional structure with a screw driver between the motor and the grating. Finally some basic test results of the near infrared spectrometer were presented, and glucose solution was analyzed by qualitative experiments.

Keywords: Near infrared spectroscopy Cary principle Czerny-Turner structures Harmonic motor TracePro

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