Investigation Of Key Technology On Portable Raman Spectrometer

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Abstract/Summary: **Request the full-text of this thesis**

The intensity of Raman light is very weak, which is only from10-12to10-6of the incident light. Based on the Shell-Isolated Nanoparticle-Enhanced Raman Spectroscopy (SHINERS) method, Raman optical spectrum signal can be enhanced significantly and the portable Raman spectrometer combined with SHINERS method will be widely used in various fields.In order to obtain the required sensitivity, the traditional Raman spectrometer tends to be heavy weight and large volume, so it is often used as indoor test device. On one hand, the purpose of the research of portable Raman spectrometer based on SHINERS is mainly to satisfy the handheld operation and real-time convenient detection. On the other hand, Miniaturization and portable development of the equipment will facilitate SHINERS technology popularization.The laser source must be stable enough and able to output monochromatic narrow band laser with stable power in the portable Raman spectrometer based on the SHINERS method. When the laser is working, the change of temperature can induce wavelength drift, thus the power stability of excitation light will be affected, so we need to strictly control the working temperature of the laser.In order to ensure the stability of laser power and output current, this paper adopts the WLD3343laser constant current driver chip of Wavelength Electronics company and MCU P89LPC935to drive LML-785.0BF-XX laser diode. Using this scheme, the Raman spectrometer can be small in size and the drive current can be constant. At the same time, we can achieve functions such as slow start, over-current protection, over-voltage protection, etc. Continuous adjustable output can be realized under control, and the requirement of high power output can be satisfied.Max1968chip is adopted to realize the accurate control of the laser's temperature. In this way, it can meet the demand of miniaturization. In term of temperature control, integral truncation effect of traditional PID algorithm is big, which is easy to cause static difference. Common PED algorithm includes incremental PID algorithm and the position type. Each output of position type is associated with the current position, and the output is full dose, so generally the incremental PID is adopted. Each output of incremental PID algorithm has nothing to do with the current position, and we can control the output coefficients to avoid full dose output and immoderate adjustment, then the speed of balance will be improved observably.Variable integral incremental digital PID algorithm is used in the TEC temperature control system. The experimental results show that comparing with other schemes, the output power of laser in our scheme is more stable and reliable, moreover the peak value is bigger, and the temperature can be precisely controlled in±0.1℃, then the volume of the device is smaller. Using this laser equipment, the ideal Raman spectra of materials can be obtained combined with SHINERS technology and spectrometer equipment.CCD, the data acquisition device, easily generates thermal noise with the increase of the operating temperature of the device. Usually, in order to suppress the dark current noise, CCD must be worked at low temperatures, but at the same time, the transfer efficiency of the charges in the CCD decreases as the temperature decreases. Therefore, in order to obtain the highest operating efficiency of CCD and to make sure the CCD work at optimum temperature, the temperature of the CCD requires to be controlled strictly. In this paper, in order to achieve precise temperature control the CCD, the cooling circuit based on Max1968chip is used.As for data acquisition and processing modules, the paper adopts spectral software based on S3C6410embedded platform to realize rendering spectral curve, processing and saving data functions. Spectral data is read by the USB chip FT245R, spectral software is written using C#based on wince6.0. After testing, perfect spectral curve can be drawn.Finally, the paper summarizes the work of the full text, and the future development of portable Raman spectrometer is proposed.

Keywords/Search Tags: **SHINERS technology**, **Portable Raman Spectrometer**, **High power laser**, **Incremental PID algorithm**, **CCD cooling**, **spectral software**, **C#**

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