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Backscattering and Transmission Raman Spectroscopy Systems in the Quantitative Analysis of Solution Concentration

Raman spectroscopy is a set of techniques based on Raman scattering properties, widely applied to analyze the composition of various substances. The techniques consist of 1) Backscattering, which collects Raman signals scattered from the surface of a sample; and 2) Transmission, which collects Raman signals transmitted by the surface of a sample in the opposite direction of a light source (which triggers less fluorescence than the Backscattering). This paper combines Transmission Raman with Backscattering Raman to observe optical accessories such as convex lenses, beamspliters, optical filters, and objective lenses. The experiment system is set up on an optical table using a 532 nanometer diode laser with 100 milliwatt power as the light source. A long-pass filter is used to block light (with a wavelength shorter than 532 nanometers) from the excited samples, as the Raman signals are much weaker than the light source. At the same time, an objective lens is used for amplifying the Raman signals from the sample substances. Then, the amplified Raman signals are collected and analyzed by a dispersive spectrometer. For the experimental samples, there are 3 substances being analyzed in this system; Toluene solution, Acetone solution, and n-Hexane solution, each prepared at a few ranges of concentrations, which are 5 mol/L, 10 mol/L, and 15 mol/L. The result reveals that the system is able to distinguish the sample solutions at different concentrations, either liquid or solid state, as the system is set to enable two selectable modes in one configuration. So, this Raman system is more adaptable for a greater variety of objects.

Keywords: Raman spectroscopy, Backscattering Raman spectroscopy, Transmission Raman spectroscopy, Molarity

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