Evolving Vibrational Spectroscopy

From scientific curiosity to outstanding routine analysis applications

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Fundamental science sometimes can take long until it is useful for practical applications. So did Raman Spectroscopy. For a long time, it lacked powerful excitation and sensitive detectors.

Since the technology evolved, the number of exciting applications was booming. Modern Raman spectroscopy has significant advantages, especially in sample preparation.

While MIR (mid IR) samples often must be prepared with some effort, modern Raman spectrometers can just easily point at the sample and measure. No cut out, just leave the sample as it is.

Non-destructive measurements obviously are important in gemmology [1] and mineralogy, even in space [2]. In the field of Archaeology [3,4,5,6], pigments in precious ancient paintings, scrolls or books can be identified. This application is also used to identify fraud and falsification.

Studies of a medical school reported that Raman can be applied to distinguish cancer tissue from healthy one [7].

Due to the mobility and ruggedness of the hardware, Raman spectroscopy can be used for police, firefighters, and military applications: identification of explosives and illicit drugs or warfare substances.

With SERS (Signal Enhanced Raman Spectroscopy), Raman can even be used for trace analysis. The SERS effect enhances the sensitivity of the Raman signal by a factor of up to 10^7. This enables, e.g. measuring pesticide residuals [8, 9] on fruit or vegetables surface for food safety. It can as well be used to identify traces of drugs e.g. in urine [10].

However, one of the most common Raman-applications is the identity check or verification of incoming goods in the pharma industries. Users appreciate the ease of use and the ruggedness of the Raman hardware.

A complementary technology is NIRS (Near InfraRed Spectroscopy) which offers some additional advantages: It can quantify water, which is impossible for Raman. NIRS enables the simultaneous quantification of several ingredients, including some physical parameters such as viscosity, density and crystallinity. Here also the technology is evolving towards compacter instruments, faster measurements and easy model generation, which all end in increasing efficiency and reducing operational cost.

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