

Bonanza - Exploring the unlimited possibilities of B&W Tek's miniature spectrometers



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"Ask the right questions, and nature will open the door to her secrets"

Sir C.V. Raman

The mysteries of our origins have intrigued humans since the beginning of time. Are we alone in this entire universe? Is there the possibility of a strange creature living on a distant planet far away? Can we explore these mystic lands physically? If not, then perhaps we could devise a way to reach these unique locations and get a feel for them ourselves.

One such science-driven exploratory expedition was the 'Exomars' payload mission launched in 2018. In preparation for this mission, a **Raman Spectrometer** manufactured by B&W Tek was used in analysis to show feasibility of Raman for this exploratory mission.

This instrument had the vital responsibility to analyze powdered samples drilled from a sedimentary rock, breccia - commonly found on Mars. Studying breccia samples helps in our understanding of the evolutionary history of planetary bodies. In addition to this, the Raman studies served to evaluate the performance of the analysis of these samples that are analogs to those on Mars to explore the possibility of life on Mars.



In order to truly to test this, Sansano et al and the Artic Mars Analog Svalbard Expedition (AMASE, 2010) team from the Unidad Asociada, UVA-CSIC Center for Astrobiology collected carbonate samples from the Svalbard Islands of the Arctic regions on Earth as they have a similar environment to that of Mars. In addition to this, coarse distribution of minerals were plotted and studied along with discovering the possibility of mineral abundance on Martian Soil. [1]

It is clear from the exploration of mystic lands such as Mars that spectroscopy can help in unfolding nature's secrets and can provide key information for the benefit of humankind. Spectroscopy is applied to diverse fields such as semiconductors, pharmaceuticals, mineral identification, gem stone testing, food quality inspection etc.

For example, you could simply take a visit to one of the pristine museums in Italy to study the painting materials used by the famous Venetian painter, [Jacopo Tintoretto](#) and his bold artwork, "Wedding Feast at Cana."

This can be achieved by utilizing the principle of Fiber Optics Reflectance Spectroscopy (FORS) and by acquiring the spectra with a [Quest™U](#) spectrometer and [BWSpec®](#) software by connecting a tungsten lamp to a Y shaped silica glass fiber bundle containing seven fibers.

FORS was used as a complementary method coupled with Raman spectroscopy and mainly used in the preliminary identification of colorimetric data.

Furthermore, one could acquire knowledge about varnish composition and pigment identification (orange pigments such as realgar and orpiment) to help in the restoration project of these beautiful paintings using the non-invasive Raman spectroscopy with the help of a [portable i-Raman 785S](#). [2]

Alternatively, you could take a trip to Spain - one of the largest producers of Sherry

vinegar of protected designation of origin (PDO) to test the quality of samples of sherry vinegar. With the help of the [Quest™X](#), fluorescence spectra can be collected to quantitatively measure product adulteration. [3]

What if you want to detect the presence of insecticide on plants? You could test this by measuring Surface-Enhanced Raman Spectrometer (SERS) signals with a portable [Exemplar® Pro](#) and find residues of dimethoate (or DMT, a commonly used insecticide to protect olive trees) in water, olive leaves or other plants in agricultural fields as shown by researchers in this paper. [4]



Picture: Jacopo Tintoretto's "Wedding Feast at Cana"



Additionally, laser-induced breakdown spectroscopy (LIBS) can prove to be effective in discriminating between authentic and false tax stamps on alcoholic beverages. The LIBS analyzer is built with a compact, **Exemplar® LS** mini spectrometer and combined with a 1053 nm laser. LIBS spectra were examined by chemometric methods based on samples from two regions of the label - a region containing a hologram and a region of blank paper. [5]

In the field of medicine, one of the CCD spectrometer models such as the **Exemplar®** paired with a blue LED light source (peak wavelength set to 475 nm) can explore the potential of photodynamic therapy. In a sterilized laboratory environment, fluorescence spectra of blue-light irradiated on plaque staining agent, Phloxine B investigations were undertaken to eliminate dental caries (in particular, *streptococcus mutans* - a common pathogenic bacterium) present in deep pits and fissure grooves. [6]

These are some examples of the many possibilities of OEM spectrometers created by B&W Tek. From this selection of published papers, one can see how our spectrometers are used around the world across diverse industries.

B&W Tek has been in the spectroscopy industry for more than 24 years. This wealth of acquired knowledge and experience over the years has helped in exploring the unlimited applications of spectrometers. From of origins in providing custom solutions using laser diodes and diode pumped solid-state lasers (DPSS), we have grown to a full-service provider of spectrometer modules, light sources, accessories, portable Raman systems and handheld Raman solutions.

In addition to this, we offer the all-new breadboarding **Discover-It-Yourself Raman building block** configurations. This article gives a sneak peek into the ever-evolving world of spectroscopic possibilities created and manufactured at B&W Tek.

To know more about our spectrometer models and other customization options, please feel free to **contact us**.



References

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