# The GL Gem Raman – a powerful tool in gem and mineral identification

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Raman spectroscopy is particularly useful in identifying and characterizing gems and minerals. Recent advances in optical technologies, innovative design of Raman geometry and miniaturization of spectrometers with real-time software allow for lower production cost and practical applications in geoscience related fields. Due to its non-destructive technique it is very useful for gemmologist appraisers, gem merchants, mineral collectors and others.

After the introduction of a UV-VIS-IR portable spectrometer (GL Gem Spectrometer) as a gem testing tool certain limitations of transmission spectroscopy led to the feasibility study of a compact and portable Raman system. The following aspects were important and could be realized for a reasonable price point (under US $ 7,000):

The GL Gem Raman is built to highest operator safety through fully enclosed and screened optics; see diagram for the optical design of the back-scattering geometry. To achieve highest signal strength no fiber optical connections are being used.

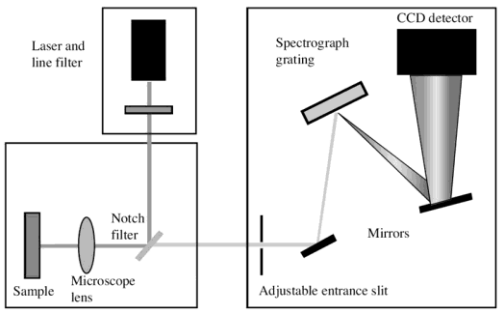


*Fig. 1 System layout of the GL Gem Raman*

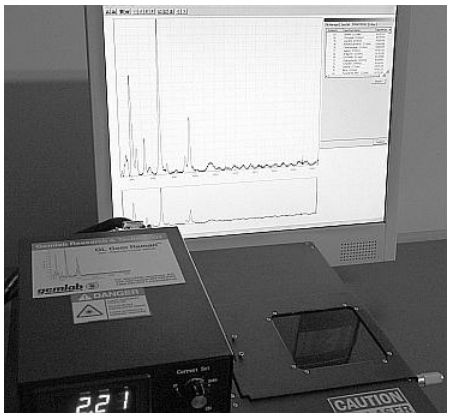


*Fig. 2 Software link to database*

A 300 mW 532nm laser excitation source was chosen as commercial units are now available at economical prices. These devices use diode lasers to “pump” a Nd-YAG laser which operates at 1064 nm. The light in this laser is frequency-doubled to give green 532 nm light output. This wavelength is about optimum for both Raman efficiency and the detector operating range.

The Raman spectral range is from 200 – 2,500 cm-1 with a resolution of ~3cm-1 ; the spot size is approximately 10 – 15 micron at 10x magnification. Laser output under 300 mW is usually sufficient and safe for the sample.

Raman CCD detectors have problems with fluorescence which in some cases “overwhelms” the signal; for those gem materials other testing instruments such as the GL Gem Spectrometer must be used.

Raman spectroscopy is scattering-based, not transmission/reflection; i.e. no need for sample preparation. Only a small sample area is required; there are no movable optical parts and maintenance is minimal.

The GL Gem Raman has a sample compartment big enough to accommodate larger specimen and single pieces of jewellery.

The GL Gem Raman quickly can tell the difference between diamond, cubic zirconia, glass and zircon, distinguish jadeite from nephrite, separate real from faux pearls, tell whether it is ivory or plastic. There is great potential for detecting treatments and colour enhancements in gemstones; it will help in the determination of the nature of diamonds, gemstones and minerals.

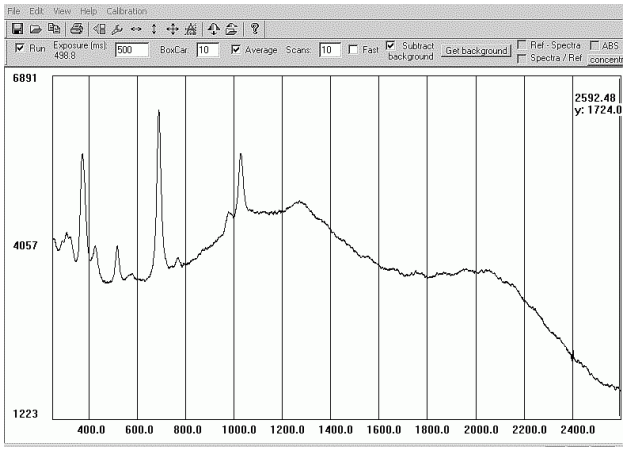


*Fig. 3 Raw spectrum of green jadeite*

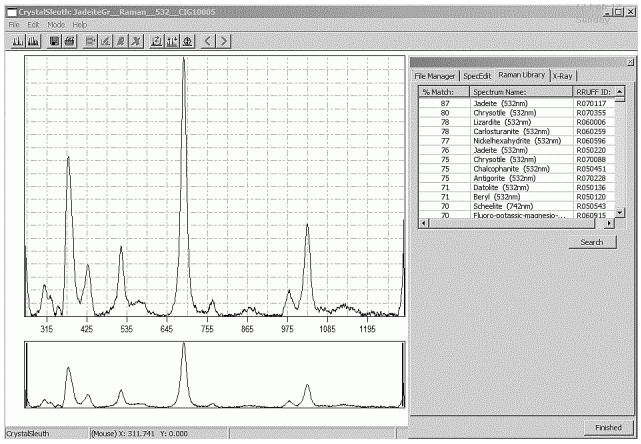

*Fig 4. Matching Raman spectrum in database*

The GL Gem Raman software allows real-time spectral acquisition. The spectra can be saved and imported into a searchable database program with over 2,500 references; the database is linked to the large on-line mineralogical RUFF database for Raman spectra.

GL Gem Raman users will also have access to the C.I.G. (Canadian Institute of Gemmology) gem reference library which is being compiled from its own large gem study collection. Other reference databases can be consulted on-line.

**References**

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RRUFF Project Website: http://www.rruff.info