

A portable Raman System for gemstone identification: The GemExpert Raman probe

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Introduction

Raman spectroscopy has been introduced in gemmology about 30 years ago, e.g. by Dhamelincourt et al., 1977, Delé-Dubois et al., 1986. The same authors have given a small collection of comparison spectra for identification. Hänni et al. (1996, 1997) gemmological applications of Raman spectroscopy. The Raman systems used so far were working with a microscope to analyse the surface or sub-surface of materials in the confocal mode. The analytical method thus analysed the host gemstone, mineral inclusions or organic fillers for hiding fissures. Databases with Raman spectra of gemstones have been published by Maestrati (1989), Ostertag (1996) and RRUFF on the internet. Conventional Raman systems are bulky and costly and need a solid bench to be calibrated. Experiences with a portable Raman system were reported before by Häberli, 2010.



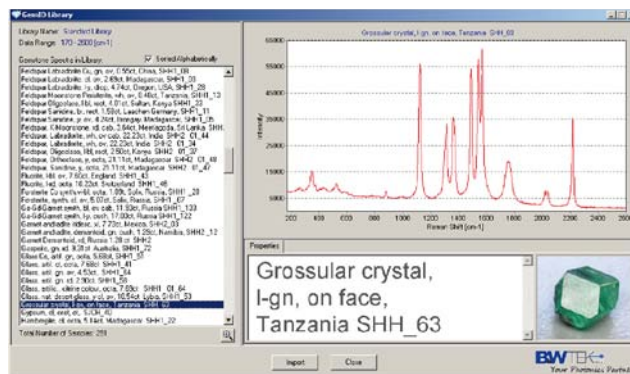
The GemExpert Raman probe with sample stage, PC with the identification programme is not shown.

The GemExpert portable Raman probe

The present GemExpert Raman produced by BWTEK is an up-to-date instrument of the i-Raman series that is in the true sense portable and affordable. It has a reference database of gemstone spectra that allows an instant identification of gemstones (Fig. 1). Equipped with a stabilized laser emitting at 785 nm (lasting for thousands of spectra recordings) and a measuring head at the end of an optical fibre, it is extremely practical to use in gemstone identification. The data base of 300 reference spectra includes common and rare gemstones from Amblygonite to Zoisite.

The advantage of a large gemstone database included into the system is evident because a confirmation with external spectra (e.g. from RRUFF library on Internet) does not necessarily have the same excitation and spectral window.

The GemExpert Raman is using the gemstone surface to identify the sample. Gemstones of about 4mm and larger can be analysed. Identification takes typically a few seconds up to a minute. The recorded sample spectrum is displayed on a PC in comparison with the best fitting reference spectrum. A report can be printed out for testifying the result and later reference.



A screen shot of sample spectrum for grossular garnet, as produced with the portable GemExpert Raman probe.

The application of GemExpert Raman is possible in a wide field, such as in gemmological laboratories, in museums, at gemstone dealers offices, and in gem mines. While a polished surface is still the best condition for identification, also crystals and uncut stones can be identified.

However, there are a few small limitations to its use: With a Raman spectrum it is not possible to differentiate between natural and synthetic stones. Inclusions in gemstones are usually too small to identify, as no microscope is attached to the GemExpert Raman in the basic equipment. Chromium-bearing gems like ruby, emerald, green jade show another restriction of the application since these stones produce a strong fluorescence that masks the characteristic Raman peaks of the sample. This problem could be overcome with a different laser source.

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