Wavelength is key

The physical basis of the technique offers huge flexibility and advantages in comparison with its sister technique, infrared spectroscopy, but at the same time presents a key challenge: the excitation needs to be highly (i) monochromatic (the Raman bands have the same shape as the light source) (ii) collimated and (iii) intense (due to the low probability of inelastic scattering, < 1 in 10^6 photons). Hence, it is the advent of lasers that has brought Raman spectroscopy – literally – into the field.

In selecting the correct laser, the wavelength is important and depends on the application. For example, fluorescence is a usually much stronger than the Raman scattering signal but unlike the fluorescence, the Raman scattering signal is observed even when exciting at wavelengths outside the absorption spectrum. Figure 1 illustrates this by showing that the fluorescence that swamps the Raman spectrum of a boron based fluorophore when the Raman spectrum is recorded at 785 nm (where absorption/fluorescence competes with the Raman process) is completely absent in the spectrum obtained at 1064 nm. Thus highlighting the importance of selecting the right excitation wavelength.

DPSS lasers for Raman

Until recently, ion gas lasers (e.g. Ar, He, HeCd and Kr) have been the first choice for Raman spectroscopy. However, the ever increasing number of wavelengths available with continuous wave diode pumped solid state (DPSS) lasers together with the high average powers (> 1 W) and compact footprint means that multi-wavelength Raman spectroscopy can be implemented as a turn key low maintenance solution in any laboratory as well as in field portable applications. For example, Cobolt DPSS lasers qualify as excellent Raman excitation sources, thanks to their extremely narrow linewidth (<1MHz), excellent wavelength stability and high level of spectral purity (>60dB).