785nm / 1064nm

Different excitation wavelengths provide specific strengths and weaknesses. Some important indicators of performance for these wavelengths are listed below:

	785nm	1064nm
Excitation Efficiency	Medium	Low
Fluorescence	Medium	Low
Sample heat absorption	Medium	High
Weak Raman compounds	Good	Bad
Detector sensitivity	High	Low
Integration time	Short	Long

- Excitation efficiency is key. Raman scattering efficiency is proportional to λ^{-4}, where λ is the laser wavelength. For example, Raman scattering at 785nm is 16 times better than at 1064nm, effectively meaning that scan time is much longer at higher wavelengths as compared to 785nm.
- Detector sensitivity is another concern. 785nm Raman systems use silicon/based CCD detectors, which have an excellent response. For 1064nm, however, typically there is no response from the CCD above 1100nm, and therefore an IR sensor InGaAs array detector, which has typically about 1/10 the efficiency of a CCD, is used. Detectors used for 785nm are much smaller and robust. Normally 1064nm systems are more expensive, bigger and heavier.
- Fluorescence. It interferes with the measurement of the Raman spectrum. To minimize interference of fluorescence, longer wavelength laser excitation could be used, such as 1064nm, which is a more energetic laser. Although current 785nm systems have solutions to compensate that difference.
- Laser absorption must also be considered as this may cause sample heating and lead to changes in the samples. Generally, the longer the excitation wavelength, the more the sample absorbs light and is heated. Thus, when using 1064nm systems for coloured, dark or black may boil, burn or ignite. There are some ways to avoid this, or at least minimize this, such as using a lower laser power, like 785nm.

Summary

The 785nm wavelength excitation is the most popular and common wavelength currently in use, as it performs efficiently for over 90% of Raman active materials with limited interference from fluorescence. Between 785nm and 1064nm wavelengths, the balance of fluorescence reduction and spectral resolution makes the 785nm the most versatile choice.

The 785nm laser provides a balance of performance with less excitation efficiency but also lower fluorescence, giving the best economic performance and making it the best choice for most chemicals.

The 1064nm laser performs with the least fluorescence but also takes the longest amount of time to get adequate levels of signal to analyse, while having a higher probability of overheating the sample.