Technical Note

TN5/2013/07

Comparison of Stray Light Performance for FLS980 Spectrometers with either Single or Double Monochromators

EDINBURGH INSTRUMENTS

Photonics Division

Comparing the stray light performance of fluorescence spectrometer systems is not a simple task. Very small signals have to be compared in respect to very large signal. An additional difficulty arises from the fact that stray light originating from monochromators is very dependent on the illumination of the monochromator optics, and that in turn is very dependent on the location and illumination of the sample.

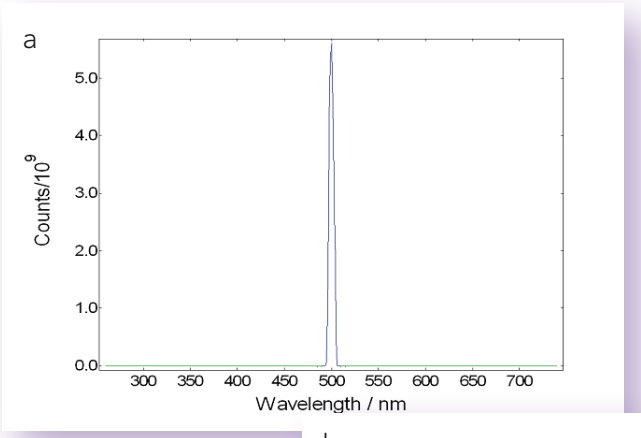
This technical note attempts to compare the stray light performance of FLS980 spectrometers, equipped with either single monochromators both in excitation and emission or double monochromators. Both monochromator types were standard, i.e. single monochromators with 1800 g/mm gratings, double monochromators with 1200g/mm gratings.

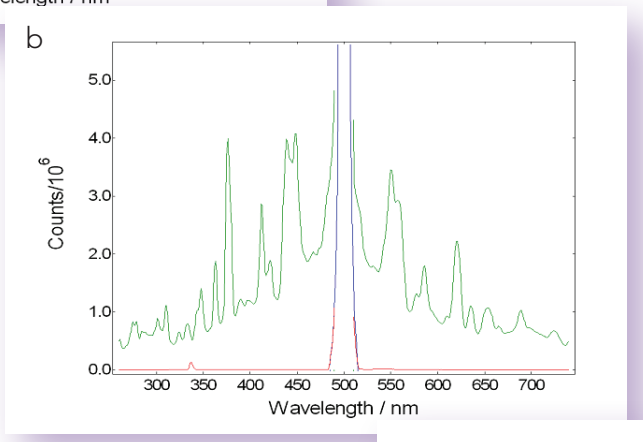
Scattering on PTFE

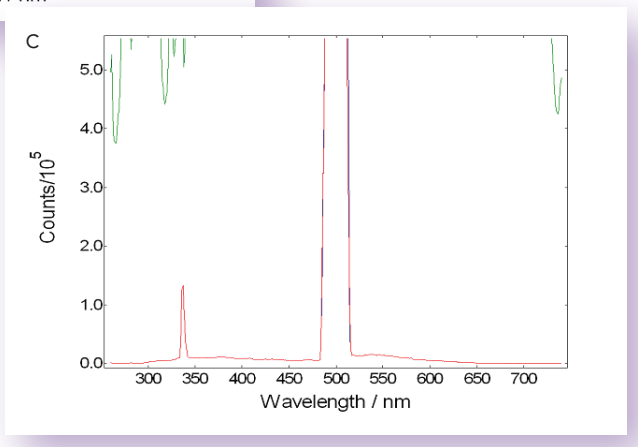
PTFE is a material that is close to an ideal scatterer. It does not have fluorescence and scatters diffusely over a wide spectral range. To measure the scattering a PTFE block was placed into the standard sample holder, the excitation monochromator was set to 500nm with a bandwidth of 5nm, the bandwidth in the emission was set to 1nm. The emission monochromator was then scanned (1s dwell, 1nm step) from 260nm to 740nm. To avoid detector saturation at the cross-over between excitation and emission the spectral range between 490nm and 510nm was omitted. Instead, a separate scan was made with a 3-order-of-magnitude neutral density filter over this spectral range. This scan was later on scaled by a factor 1000 for comparative reasons.

Figures 1a - 1C show all three measurements (single monochromator measurement, double monochromator measurement and the peak measurement) on each graph with only the y-axis being differently scaled between them. The different degree of stray light can clearly be seen. It should be noted that the stray light level for the single monochromator system is approximately 2000 smaller than the diffusely scattered spike at 500nm, while for the double monochromator system this factor is in the order of >50,000. This appears to be in contradiction to the monochromator's stray light performance figures of 10^5 (single monochromators) and 10^{10} (double monochromators). However, the performance figures are measured with a single wavelength laser (HeNe at 633nm), whereas the measurements here represent "real life performance" of the system with a broad band xenon arc light source for excitation.

(The spike at 337nm for the double monochromator measurement is likely to be a residual ghost figure from the ruled gratings of the double grating excitation monochromator.)







Figs. 1a, 1b &1c. Comparison of measurements of scatter taken with an FLS980 with single monochromators and (green curve), an FLS980 with double monochromators (red curve) and the peak measurement taken with an ND filter (blue curve). Shown scaled differently over three graphs to allow the peak to be seen and the background to be shown on measurements from both spectrometers.

Edinburgh Photonics
2 Bain Square,
Kirkton Campus,
Livingston,
EH54 7DQ
United Kingdom

Telephone
+44(0) 1506 425 300
Facsimile
+44(0) 1506 425 320

Email
sales@edinst.com
Website
www.edinburghphotonics.com

EDINBURGH INSTRUMENTS
Photonics Division