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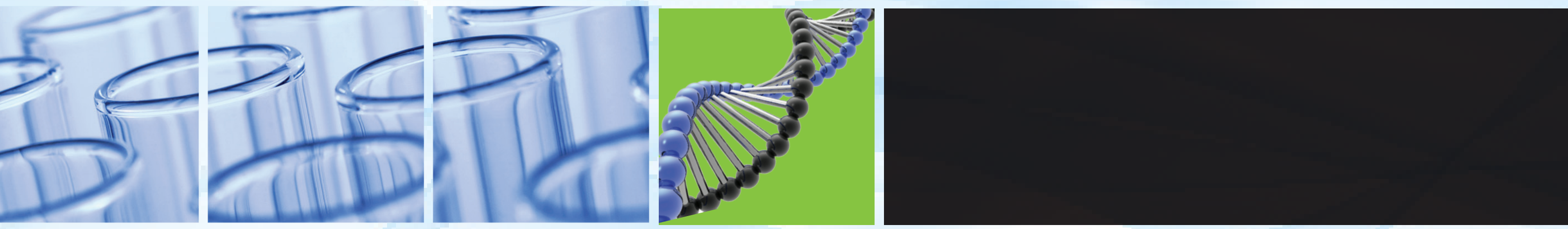
The Nanolog® Series: A New Generation of Performance

FL-31

ELEMENTAL ANALYSIS
FLUORESCENCE
GRATINGS & OEM SPECTROMETERS
OPTICAL COMPONENTS
FORENSICS
PARTICLE CHARACTERIZATION
RAMAN
SPECTROSCOPIC ELLIPSOMETRY
SPR IMAGING



Introduction

The Nanolog® (Fig. 1) has a reputation as the premier instrument for the exploration of single-walled carbon nanotubes (SWCNTs). Derived from the Fluorolog® series of the World's Most Sensitive Spectrofluorometers, the Nanolog® now benefits from improved sensitivity, plus features and software that extend its applications and configurations into new research possibilities. Experiments can run faster, increasing sample throughput and laboratory efficiency. Higher sensitivity means detection of species previously unmeasurable. In addition, an absorption accessory lets researchers measure the absorbance and transmittance of samples, to account for inner-filter effects and re-absorption phenomena that alter observed fluorescence peak intensities. Our exclusive Nanosizer software then can correct for these effects.

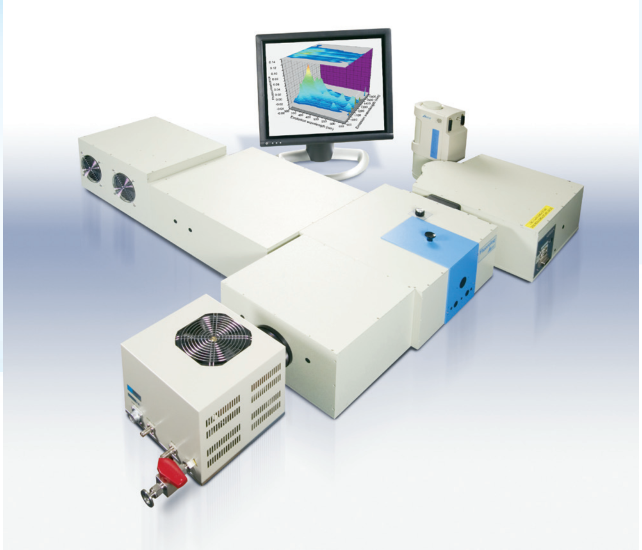


Fig. 1. Nanolog® spectrofluorometer.

Experiments and results

To demonstrate test the instrument's sensitivity, (6,5) SG SWCNT (Co-MoCAT, SouthWest NanoTechnologies) was used (0.1 mg L^{-1} in D_2O, + 0.1% NaDDBs). The sample was placed into a 1-cm path-length cuvette inside the instrument with right-angle optics. The spectrofluorometer used a N_2(l)-cooled 1" InGaAs 512 × 1 array detector, and a Schott RG830 cut-on filter (λ > 830 nm) in the emission path. With 10 nm bandpass and 2 × 5 s = 10 s integration time, the scan was centered at 1210 nm. The excitation and emission spectrometer gratings were 100 grooves mm^{-1}, blazed at 800 nm.

Photoluminescence from the sample was collected at λ_{exc} = 568 nm. Fig. 2 compares fluorescence from the original (gray) and the latest system (red), showing signal three times higher.

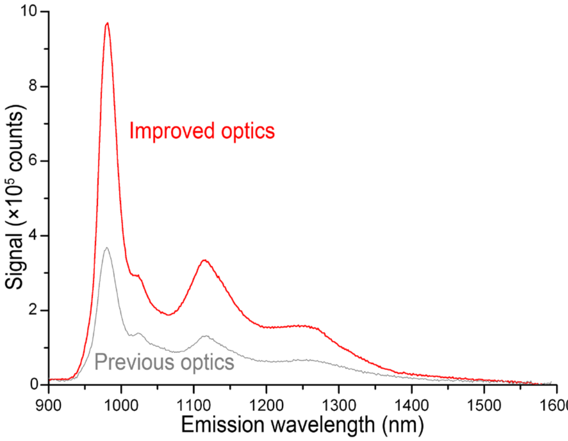


Fig. 2. Signal from the SWCNT sample. Gray: original system; red: improved instrument.

[1]SouthWest NanoTechnologies, Inc., 2501 Technology Place, Norman, OK 73071-1102

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The signal-to-noise ratio (S/N) determination used the same experimental parameters. The SWCNT sample1, in a 0.5-cm path-length rectangular cuvette, was diluted (A ≈ 0.09) and scanned from 828–1520 nm. Calculated S/N = 19 200 from the (6,5) peak and average blank signals. Exclusive HORIBA Scientific's Nanosizer software created a corrected EEM (Fig. 3); prominent peaks are labeled. The Nanosizer software also plotted a helix-angle map of the SWCNT sample's components (Fig. 4). The absorption accessory (Fig. 5) placed in the sample compartment recorded A = 0.72 at 982 nm (Fig. 6, next page) from fraction 9 of the CoMoCAT sample.

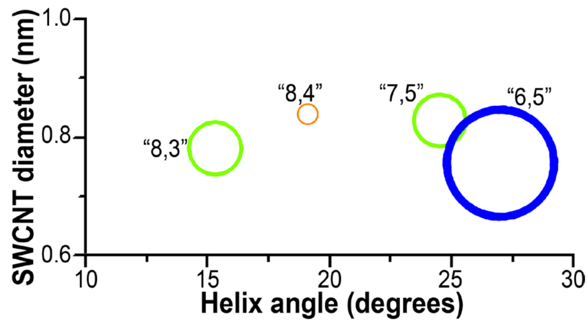


Fig. 4. NIST SWCNT diameters vs. helix-angle. Circles' diameters are proportional to intensities shown in Fig. 3.

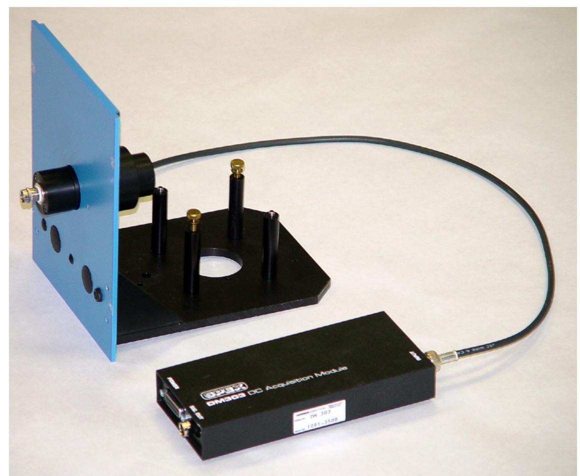


Fig. 5. Absorption accessory.

Conclusions

HORIBA Scientific has improvedextend-ed the performance of the Nanolog® spectrofluorometer with an absorbance accessory plus heightened sensitiv-ityand upgraded optics for faster throughput, more signal, and greater S/N. The absorption accessory offers better stability, precision, and speed for experiments requiring immediate higher absorption measurements concurrent with fluorescence scans. Experiments with the absorption accessory also can be applied to both metallic and semiconductor SWCNT samples.

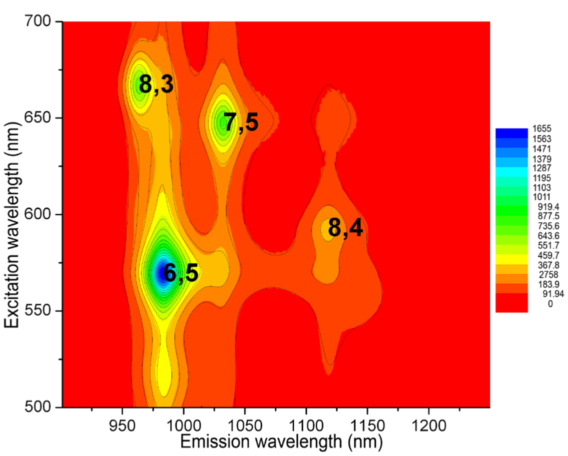
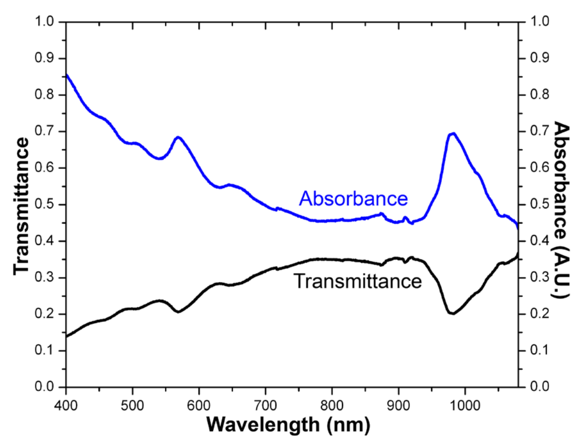


Fig. 3. EEM of NIST sample. Important SWCNTs (>10% of maximum) are labeled with (n,m) coordinates.



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