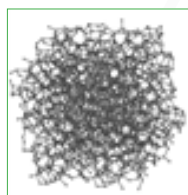
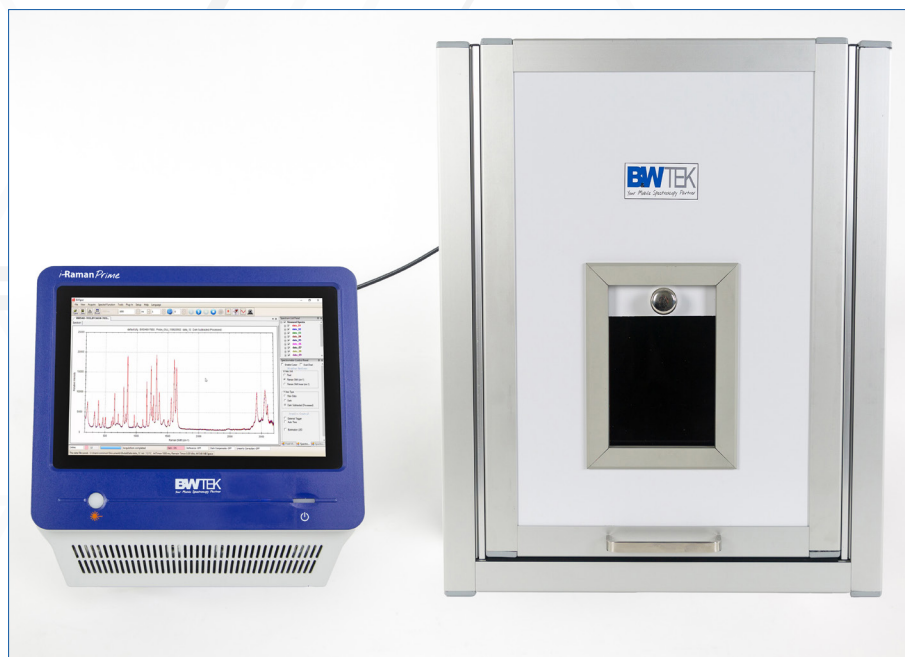
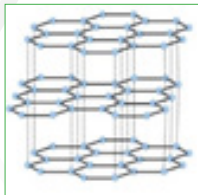


Carbon Analysis with Portable Raman i-Raman[®] Prime 532

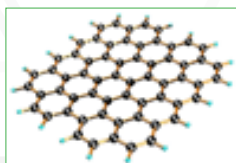
Raman spectroscopy is an ideal analytical tool for nondestructive analysis of carbon nanomaterials. Carbon nanomaterials constitute a variety of carbon allotropes including graphene, graphene oxide, carbon nanotubes, and carbon nanofibers, each exhibiting unique properties in electrical conductivity, thermal conductivity and mechanical strength. The Raman spectra of carbon nanomaterials are typically characterized by three major bands: the G-band, the D-band, and the 2D-band (also referred to as the G'-band). Though simple, the spectra of these nanomaterials are rich in information about their quality and their micro-structures, such as crystallinity and level of disorder revealed by the peak positions, peak shapes, and peak intensities.



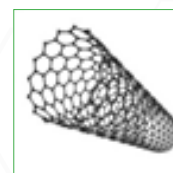
Carbon Black
(Amorphous)



Graphite



Monolayer
Graphene



Carbon
Nanotube

B&W Tek's portable i-Raman Prime 532 is equipped with a fiber-optic sampling probe is ideal for analysis of carbon materials. The system is equipped with a high-throughput spectrometer with back-thinned CCD TE-cooled to -25°C , for high sensitivity. It is ideal for materials in powdered forms, with no need for sample preparation. For easy, reproducible measurement, an optional probe holder with an adjustable xyz stage can be used, and fits inside and a Class 1 laser enclosure. A video microscope is also available, though not needed for the basic structural characterization. The BWSpec[®] software for data collection, spectral processing, and experimental set up configuration can be programed to automatically calculate various parameters such as D- and G-band intensity ratios and G-band peak heights. BWSpec[®] can calculate and monitor up to six variables with real-time results displayed in a trend plot and a table simultaneously. With such ease of use, the i-Raman Prime 532 allows graphene manufacturers to obtain at-line or on-line measurements for material characterization, product quality control, and process monitoring.

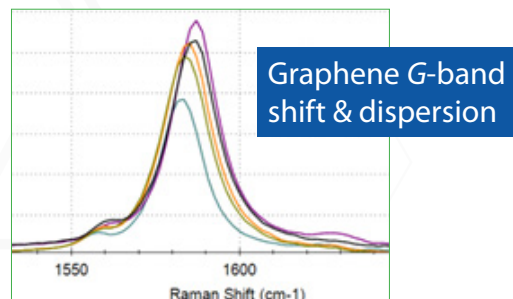
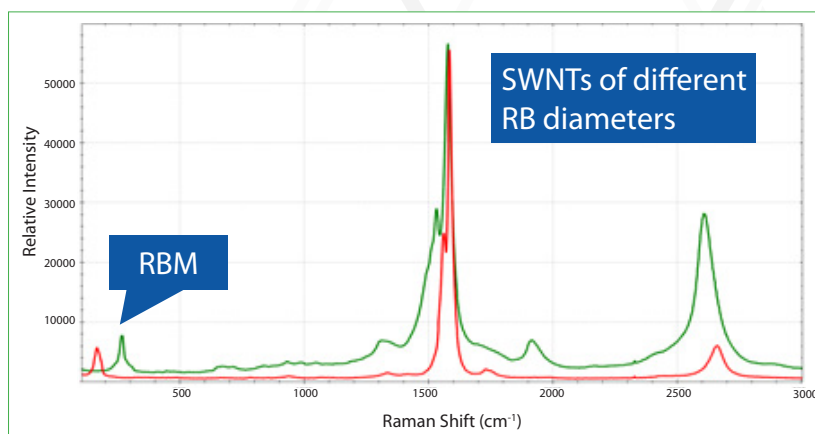
Specifications

Model	BWS475-532H-HT
Spectral Range	150 – 3400 cm^{-1}
Laser Source	Class III B with software adjustable power
Power Options	
Power Adaptor Input	100-240V AC 50/60 Hz
Battery	Optional
Physical	
Dimensions	15.7 in x 10.2 in x 9.8 in (40 cm x 26 cm x 25 cm)
Weight	~19.5 lbs (~8.8 kg)
Operating Temperature	0 °C – 35 °C
Storage Temperature	-10 °C – 60 °C
Humidity	10% - 85%, non condensing

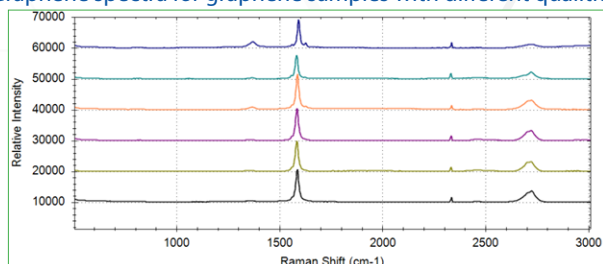
*Resolution measured using atomic emission lines. Raman resolution per ASTM E2529-06 (Standard Guide for Testing the Resolution of a Raman Spectrometer) available upon request.

Tabulated Graphene D-band height, G-band height, I_D/I_G

Sample	I_D	I_G	I_D/I_G
1	216.25	2851.33	0.0758
2	184.20	2898.98	0.0635
3	210.14	3067.50	0.0685
4	449.27	2987.06	0.1504
5	188.05	2101.31	0.0895
6	957.56	2052.60	0.4665



Graphene spectra for graphene samples with different qualities

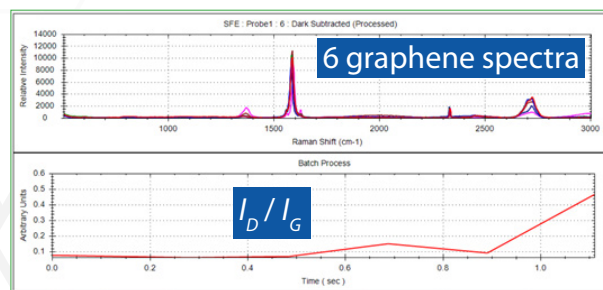


Applications

- Graphene powders G-band shift, G-band dispersion, area ratio of G-band over 2D-band
- GO or rGO I_D/I_G
- CNT (SWNT and MWNT) I_D/I_G , RBM for SWNT
- Carbon nanofibers CNT weight % and I_D/I_G
- Carbon black materials I_D/I_G
- Manufacturing process residuals (such as iron oxide) detection

Features

- Portable Raman system with 532nm laser excitation
- BWSpec® software with Timeline Experiment and Batch Re-Process configuration for automatic result and trend plot display
- No microscope needed
- Non-destructive analysis
- No sample preparation



(Doc Rev: 40000243-B Edited 5/14/2020)