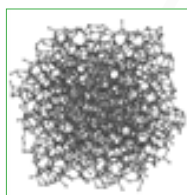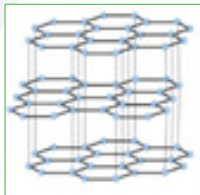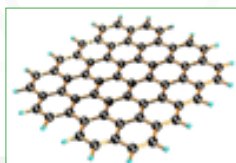# B&W Tek Portable Carbon Raman Analyzer
i-Raman® Prime

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.
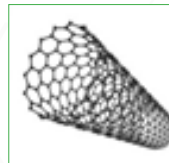
Carbon Black (Amourphous)

Graphite

Monolayer Graphene

Carbon Nanotube

B&W Tek's Carbon Raman Analyzer (CRA) is a portable Raman system with 532nm laser excitation and a fiber-optic sampling probe. The CRA is equipped with a high-throughput spectrometer with back-thinned CCD TE-cooled to -25°C. It is ideal for materials in powdered forms, with no need for sample preparation. For easy, reproducible measurement, the CRA package includes a probe holder with an adjustable xyz stage and a Class 1 laser enclosure. No microscope is needed for the analysis. 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, CRA allows graphene manufacturers to obtain at-line or on-line measurements for material characterization, product quality control, and process monitoring.
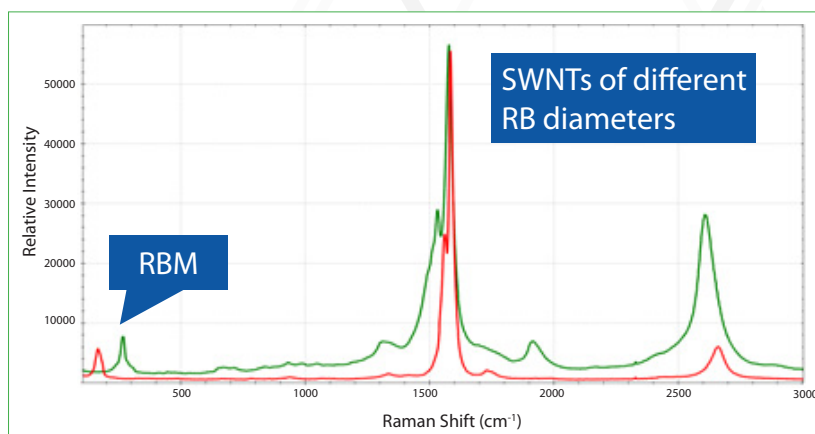
Specifications

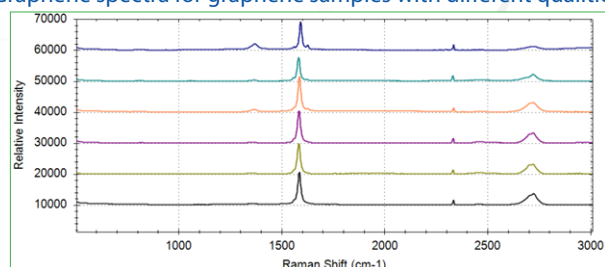| Model	BWS475-532-HT
Laser Source	Class III B with software adjustable power
Power Options	
Power Adaptor Input	100-240V AC 50/60 Hz
Battery	Optional
Physical	
Dimensions	15.7 in x 10.2 in x 9.8 in (40 cm x 26 cm x 25 cm)
Weight	~19.5 lbs (~8.8 kg)
Operating Temperature	0 ˚C – 35 ˚C
Storage Temperature	-10 ˚C – 60 ˚C
Humidity	10% - 85%

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

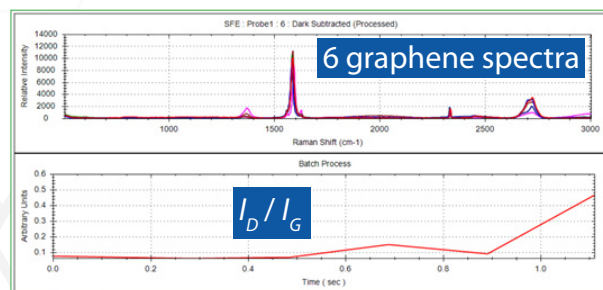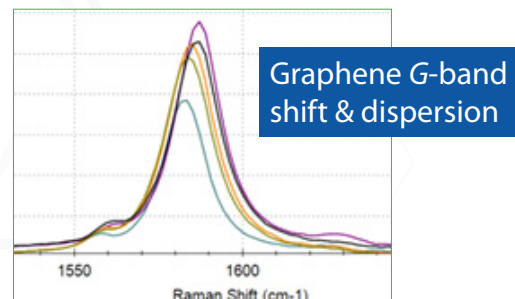| Sample	I_D	I_G	I_D / I_G
1	216.25	2851.33	0.0758
2	184.20	2898.98	0.0635
3	210.14	3067.50	0.0685
4	449.27	2987.06	0.1504
5	188.05	2101.31	0.0895
6	957.56	2052.60	0.4665

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

• Class 1 laser enclosure

• No microscope needed

• Non-destructive analysis

• No sample preparation

SWNTs of different RB diameters

RBM

Graphene *G*-band shift & dispersion

Graphene spectra for graphene samples with different qualities

6 graphene spectra

I_D / I_G