HYDROGRAPH

FGA-1 Fractal Graphene Aggregate Technical Datasheet

Hydrograph Clean Power Inc.
809 Levee Drive Suite H
Manhattan Kansas 66502
+1 785-380-4205

Product Number: FGA-1	**Product:** Fractal Graphene Aggregate

Product Description

A few layer, non-functionalized, turbostratic graphene in a powdered form of aggregated nano-platelets from carbon-rich gas explosion synthesis

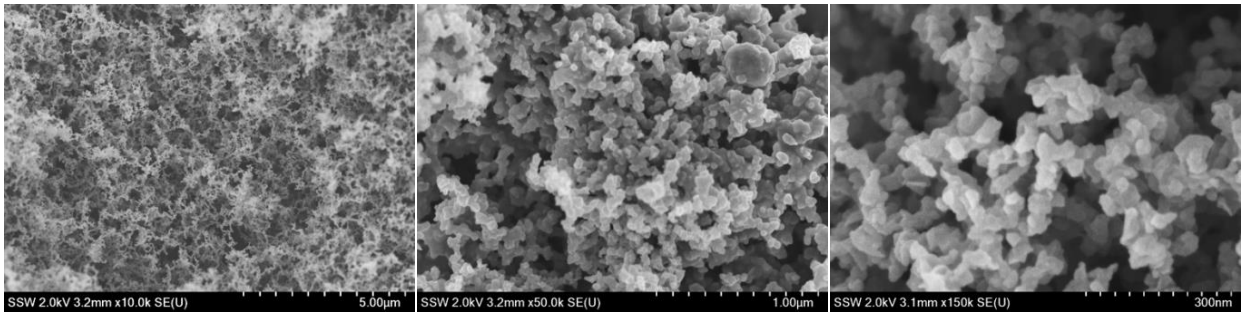
Product Information	
Production Method	Explosion Synthesis
Raw Material	Carbon Bearing Gas
Forms of Materials	PWD – Dry Powder

Characteristic	Test Method	Value
SP2 Bonded Carbon	RAMAN, XPS	Yes (G peak), 100% sp2 (D parameter)
Structural Defects	RAMAN	D/G = 0.68 G width = 39cm^{-1}
Number of Layers	RAMAN, X-Ray Diffraction	6-layer average
Z-Axis Dimensions	RAMAN, X-Ray Diffraction, AFM	3 ± 0.5 nm
Primary Particle Shape	TEM, Light Scattering	Platelets (aggregated)
Lateral Dimensions	TEM	20-50nm
Aspect Ratio	TEM	1:15
Bulk Density	Manual Tapping	70-100mg/mL†
Chemical/Elemental Analysis	Chemical Analysis	C 99.8%
Oxygen Content %	Chemical Analysis	0.2%
Impurities %	Chemical Analysis	None
Functionalization	Chemical Analysis	Not Detected
Surface Particle Charge	Zeta Potential	~+13mV (pH ~6.7 in DI Water)
Graphene Orientation	RAMAN, XRD	Turbostratic
Specific surface Area (SSA)	BET	130-180 m^2/g
Crystallinity	Electron Diffraction, X-Ray Diffraction	Crystalline

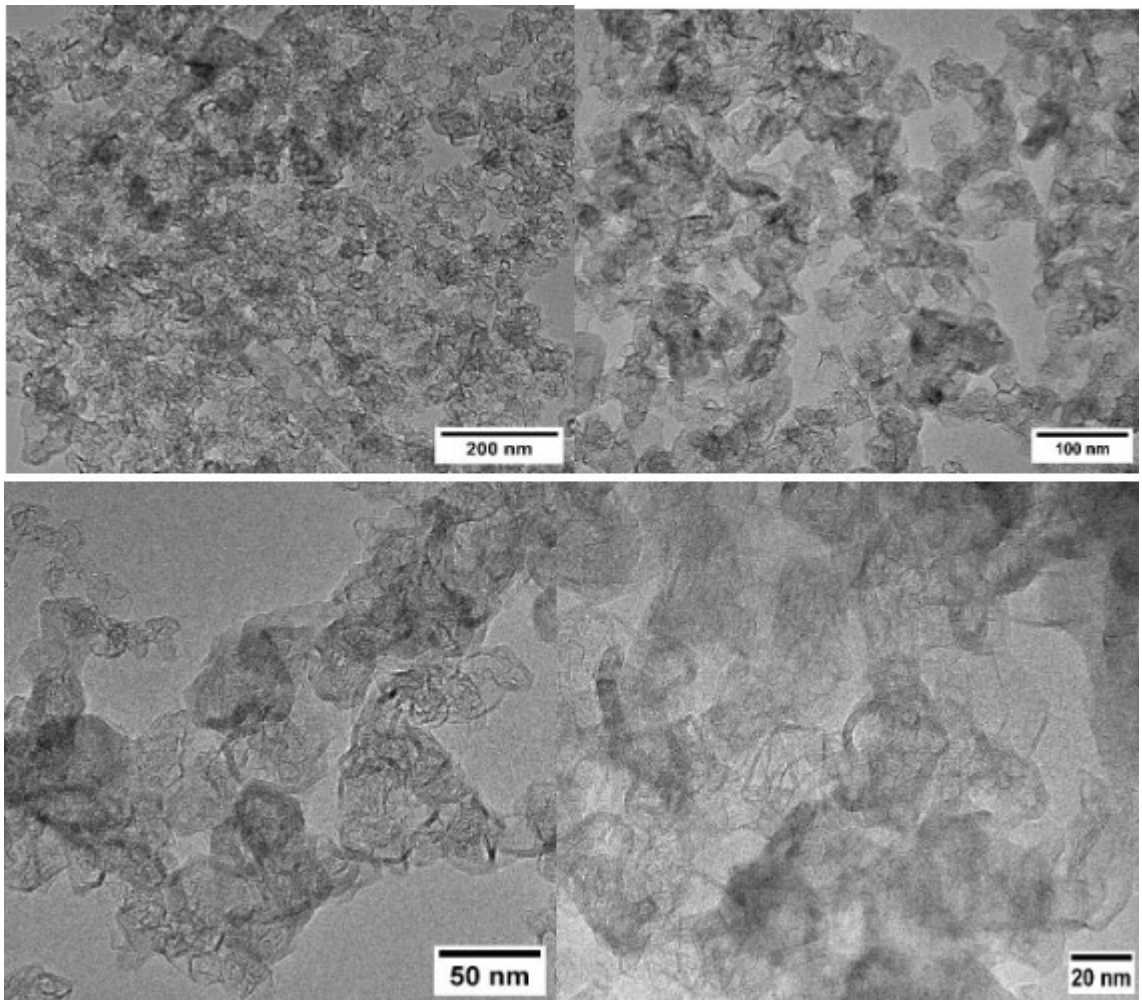
†Density may vary

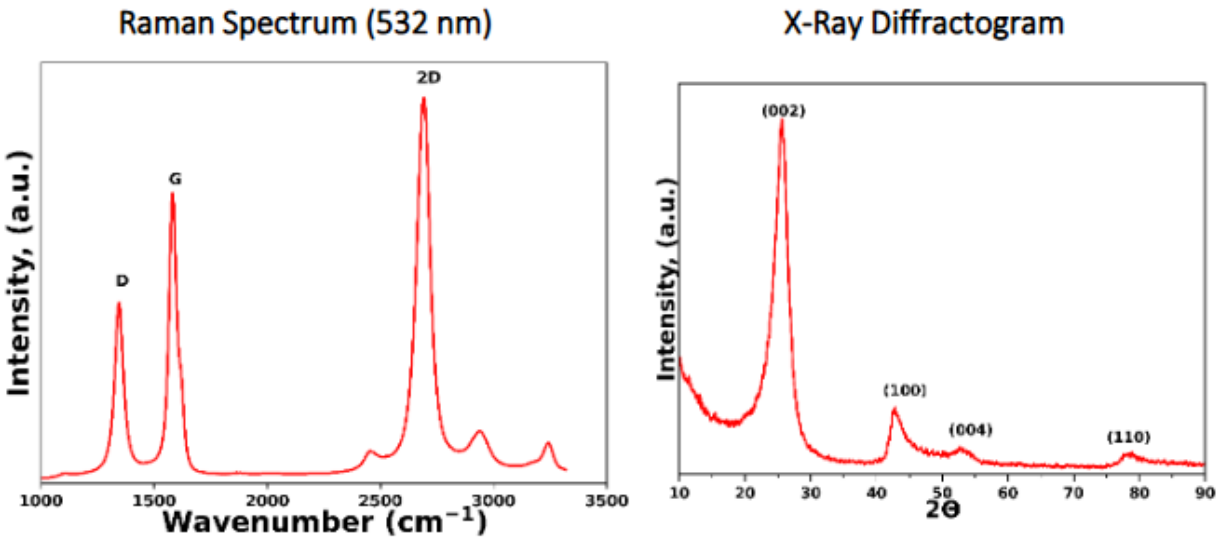
Parameters	
Appearance	Black fluffy powder
Number of Layers	≤ 10 layers
Lateral Size	Nano-platelets 20 to 50nm. Aggregates radius of gyration ~150nm
Shape and Form	Fractal aggregate of nano-platelets
Elemental Analysis	Atomic %: 99.8% Carbon, 0.2% Oxygen, No PAHs
Dispersants/Surfactants	None
Concentration	100%
Solid Content	100%
Solvent content	N/A
Substrate Material	N/A
Sheet Resistance	Not applicable
Color	Light absorbing. Black L*=2.6, a*=-0.12, b*=-0.79 (10^0 observer/D65 Illuminant)
Odor	None
Solubility in Water	Hydrophobic
Electrical Conductivity	Function of powder compression. 100-300Sm^{-1}
Thermal Stability	Thermo-gravimetric analysis (TGA) shows: In nitrogen- No volatiles up to 700°C In air- Stable up to 544°C, Tmax=725.5°C (at dT/dt=10^0C/min)

Scanning Electron Micrographs



Transmission Electron Micrographs





Notes on Analysis:

- The turbostratic nature is indicated by the asymmetric (100) peak in the X-Ray Diffractogram and the symmetric Lorentzian 2D peak in the Raman Spectrum.
- AFM- The aggregate nature of our fractal graphene is not amenable to AFM analysis.
- Raman- The nanoscale lateral dimensions of our monomer platelets leads to a high fraction of defect edge sites which enhance the intensity of the Raman D bands.