# CICARBO™ GRAPHENE NANOMATERIALS

CELTIG, LLC is a Tennessee limited liability company founded to produce high-quality graphene nanosheets or flakes and to distribute commercial quantities of this line of products to markets worldwide. CELTIG manufactures 3 grades of nanomaterials suitable to a wide range of industrial applications. *(See individual product data sheets for technical specifications.)*

PRODUCT INFORMATION

Form: Light powder
Color: Dark gray to black
Odor: Odorless
Carbon content: Grade dependent (95.5 to 99.9%)
Moisture content: Grade dependent (< 2.0%)
Ash content: Grade dependent (0.1 to 4.5%)
Dry powder resistivity: < 100 ohm cm
Sheet resistivity: ~10 ohm/square (Grade dependent)
Particle size range: Grade dependent (100 nm to 10 μm)
Mono-, bi-, and tri-layer content: Grade dependent
Dry powder density: ≈ 100 to 200 kg/m^3
True density: 2.2 g/cm^3
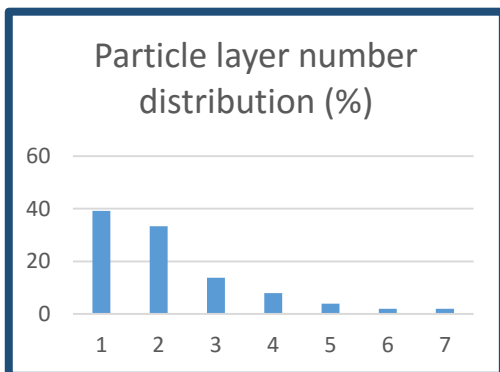**Specific surface area:** Grade dependent (≈ 100 to 350 m^2/g)

MATERIAL CHARACTERIZATION
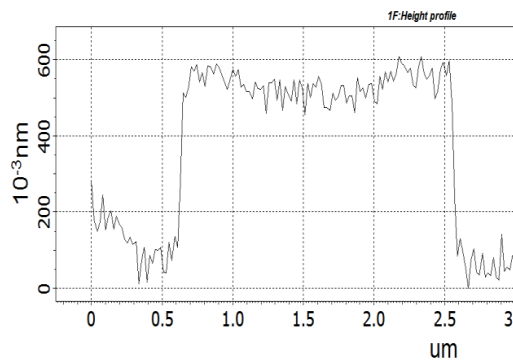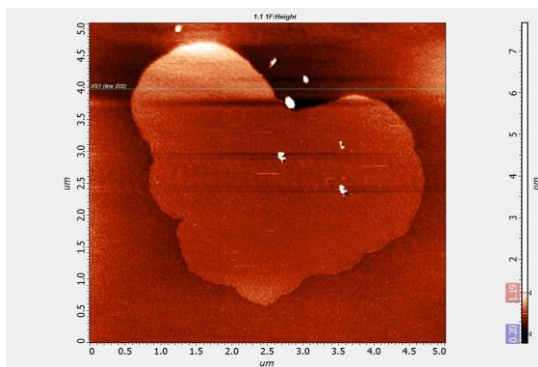
AFM image of single-layer graphene nanosheet
► The left image displays a single layer of graphene.
► Sheet dimension measures roughly 3-4 μm.
► The right image is the height trace of the nanosheet.
► Monolayer thickness is approximately 0.4 nm (4 Å).

Particle layer number distribution (%)

Typical nanosheet layer number distribution
(Premium grade)
► Approximately 40% of nanosheets are monolayer.
► Approximately 33% are bilayer.
► Approximately 14% are trilayer.
► Minority of nanosheets range up to 7 layers in thickness.
► Distribution based on AFM images of > 300 nanosheets.

Particle size distribution (%)

Typical nanosheet size number distribution
(Premium grade)
► Distribution based on AFM images of > 300 particles.
► Majority of nanosheets have sheet dimensions between 100 nm and 1.5 μm.
► Nanosheets dimensions range in size up to 6 μm.
► Nanoplatelet dimension distribution is a tunable property (grade dependent).
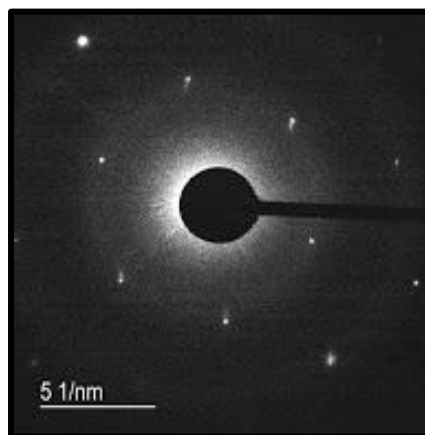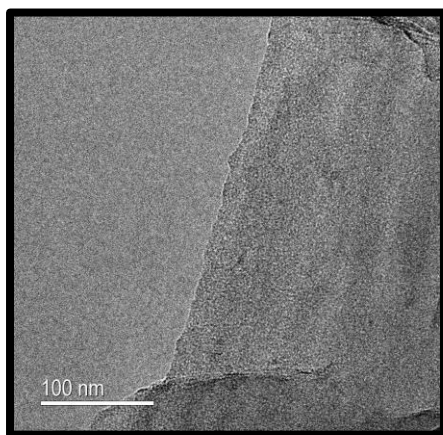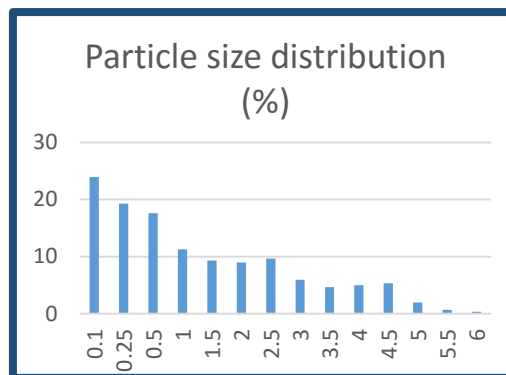
TEM image and diffraction pattern of monolayer graphene nanosheet

► The left image is a close-up HRTEM image displaying a monolayer graphene nanosheet.
► Nanosheet under focus has planar dimensions of approximately 1.5 μm.
► The thickness of the nanosheet is approximately 0.4 nm.
► The right images is the TEM diffraction image of the nanosheet in the left image.
► The diffraction pattern displays the characteristic hexagonal packing image of monolayer graphene.

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