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| <h1>Graphene Acid</h1> <p>carboxylated graphene</p> |
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Graphene acid is a covalent graphene derivative bearing carboxyl groups on both sides of the graphene surface. It is well dispersible in water, making stable colloidal dispersions at low and high concentrations. Graphene acid behaves as a 2D carboxylic acid with pK_a of 5.2, precipitating at pH below 5.2. The nanomaterial is conductive and well biocompatible.

MAIN CHARACTERISTICS

| | |
|-----------------------|------------------------------------------------------------------|
| Form | Water Dispersion of Few Layered Nanoflakes |
| Lateral size | ~500 nm |
| Purity | Approx. atomic content C: 80 %; O: 15 %; N: 4 %; F: <1 % |
| pK_a | 5.2 |
| Zeta-Potential | -32 ± 5 mV (pH = 5.5) |
| Temperature stability | Up to 240 °C (inert atmosphere) |
| Sheet resistance | $6\ 800 \Omega \cdot \text{sq}^{-1}$ |
| Surface Area | ~ 500 $\text{m}^2 \cdot \text{g}^{-1}$ (methylene blue sorption) |
| Mass concentration | $5 \text{ g} \cdot \text{L}^{-1}$ |

STORAGE AND HANDLING CONDITIONS

Storage conditions

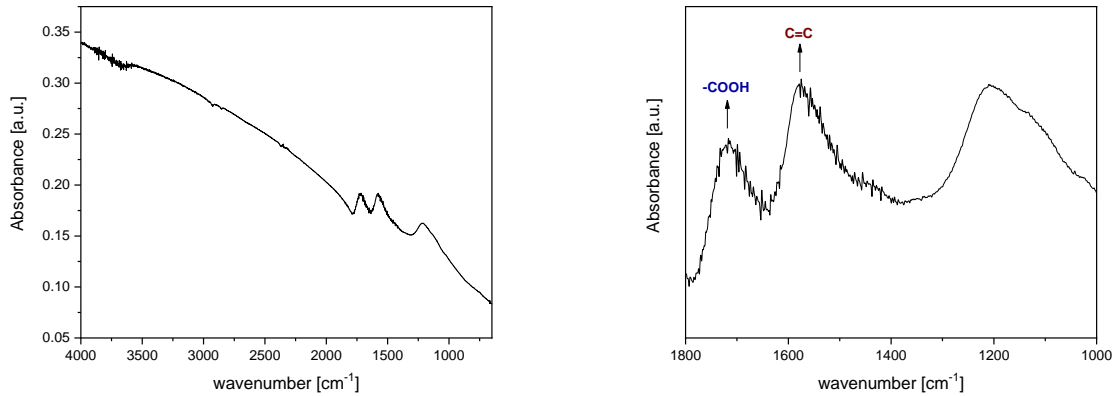
- Keep container tightly closed in dry and dark place.
- Store in cool place at 4-8°C.
- Refrigeration is not necessary during short-term transports or routine laboratory operations.

Handling of stock material

- Stock material need to be well homogenized before use.
- Use orbital shaker for 30 minutes for general dispersion.
- Sonicate material for 10 minutes to homogenize dispersed material properly.

DETAILED CHARACTERIZATION

1.1 Fourier transform infrared spectroscopy (FTIR)

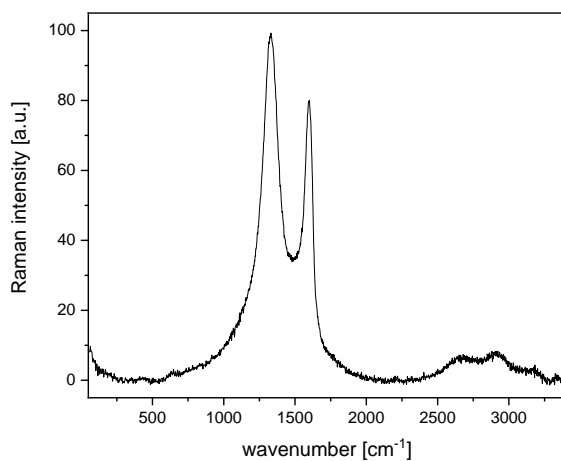


1.2 X-ray photoelectron spectroscopy (XPS)

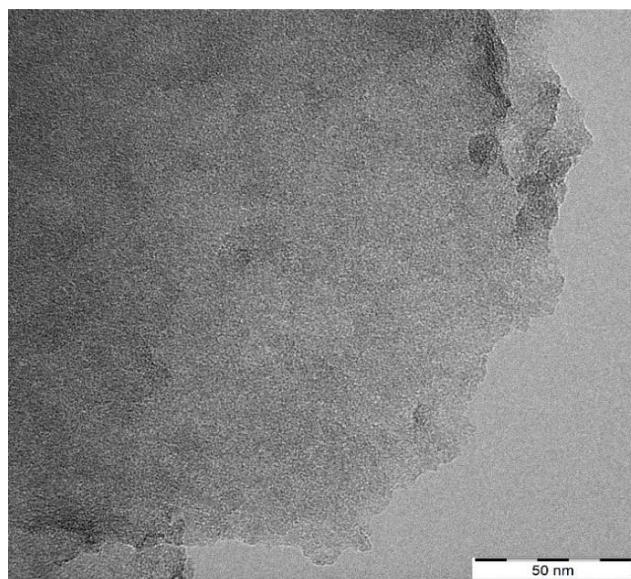
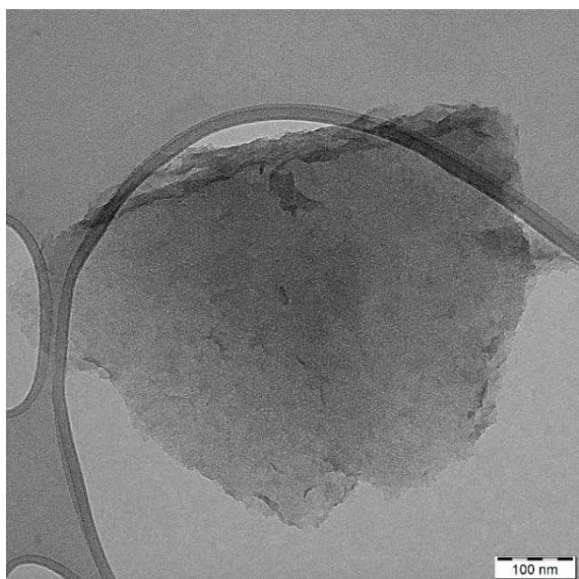
Atomic Concentration Table

| C1s | N1s | O1s | F1s | |
|-------|-------|--------|--------|--------------|
| 0.314 | 0.499 | 0.733 | 1.000 | RSF |
| 5.913 | 9.647 | 14.600 | 20.659 | CorrectedRSF |
| 79.58 | 4.86 | 15.16 | 0.40 | |

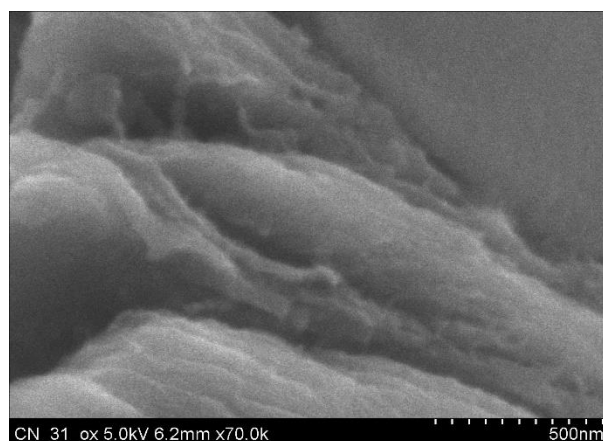
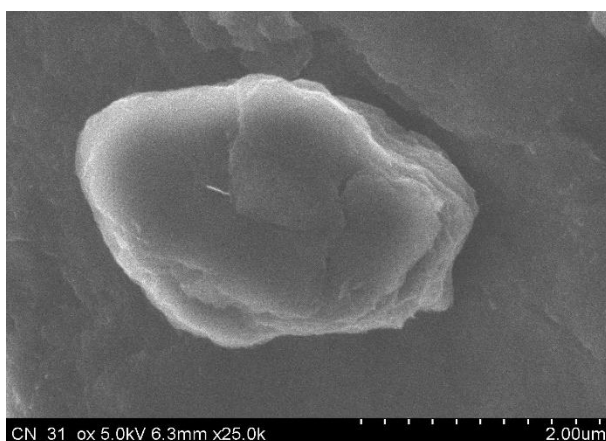
1.3 Raman spectroscopy



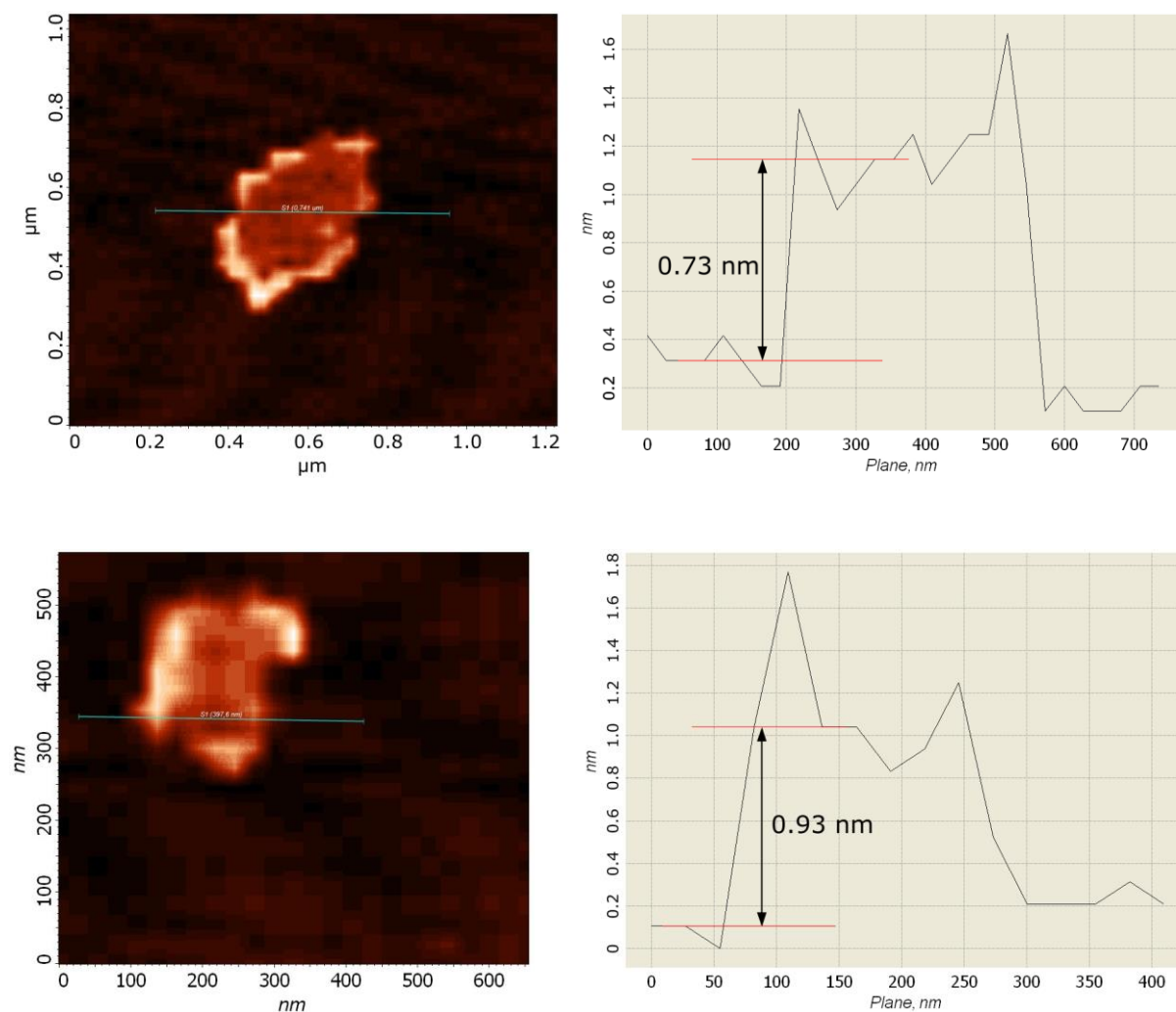
1.4 Transmission Electron Microscopy (TEM)



1.5 Scanning Electron Microscopy (SEM)



1.6 Atomic Force Microscopy (AFM)



REFERENCES

Bakandritsos et al. Cyanographene and Graphene Acid: Emerging Derivatives Enabling High-Yield and Selective Functionalization of Graphene. *ACS Nano* **2017** 11 (3), 2982-2991, DOI: 10.1021/acsnano.6b08449