

Analysis of the Dispersed State of Graphene Oxide (Isolated)

Outline

Graphene oxide is a nanocarbon material with a high aspect ratio and a high surface area with a thickness of about 1 nm and a sheet length of several to tens of microns. It has a flake-like structure with abundant oxygen functional groups and has a «high dispersibility» that is not available with other nanocarbon materials (carbon nanotubes and graphene) so far. This makes it easy to combine with various materials and can be used as a coating film or functional film. In recent years, it has been studied for applications in next-generation battery materials, antibacterial and antiviral substances, coatings, lubricants, water purification, catalysts, and other functional materials.

Due to its high aspect ratio and high dispersibility, graphene oxide forms a network in the host material when a small amount is added. For various host materials, different functions are expressed when added. In addition, since a network of graphene oxide can be formed even in very thin films, it is also suitable for use in membranes and in film shapes.

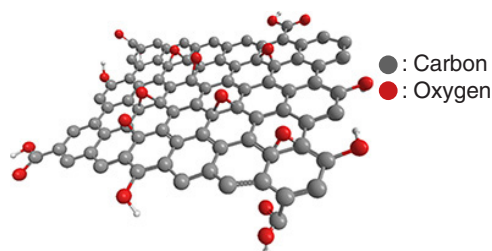


Fig. 1 Molecular structure of graphene oxide
Source: Molecular structure is used with permission from NIPPON SHOKUBAI Co., Ltd.

Method

Apparatus: HORIBA Partica CENTRIFUGE
Measurement mode: Line-start
Sample volume: 40 μ L
Samples: Sigma-Aldrich™ Graphene oxide aqueous solution (Solid concentration: 2 mg/mL)
Calibration sample: Thermo Fisher Scientific_No.8100: Silica/DI, Nominal size: 1.0 μ m, Mean: 0.99 μ m, Density: 2,010 kg/m³
Particle: Graphene oxide (Refractive index: 1.84-0.6i: Density: 2,260 kg/m³)

Medium: 8-24% sucrose density gradient solution (Average Refractive index: 1.352, Average density: 1,048 kg/m³)

Particle size distribution (PSD) base: Volume based
Calculation setting: Custom mode
Extinction coefficient correction: ON
Smoothing: 3

Results

The PSD in Fig. 2 shows the volumed-based PSD measured by Partica CENTRIFUGE calculated with the extinction coefficient correction ON, and shows a median diameter of 0.056 μ m, a mean diameter 0.059 μ m. Only singly dispersed particles in a relatively well dispersed have been observed.

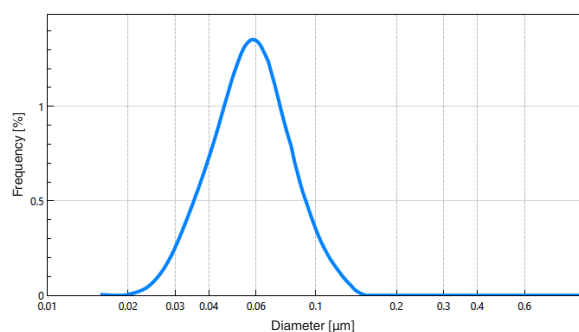


Fig. 2 Volume-based PSD

Conclusion

Water dispersibility, which was difficult with graphene and other nanocarbon materials, has been improved. The measurement result of this graphene oxide dispersion shows that the PSD of a broad single peak can be observed, showing a good dispersibility. In addition, it is possible to improve the quantitative result with absorbance correction, therefore, it is useful for the evaluation of the dispersion state of graphene oxide with a broad particle size distribution.

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