HORIBA Scientific

partica CENTRIFUGE

Applications Data Sheet

Gold Nanoparticle
ADS168

Analysis of Particle Size Distribution of Rod Shaped Gold Nanoparticle

Outline

Gold nanorods are rod-shaped gold nanoparticles. Fig. 1 shows that gold nanorods have two surface plasmon bands in the directions of the short and long axes derived from their anisotropic shapes. By changing the aspect ratio, the absorption wavelength is changed. They can be used in coloration materials, sensing materials, biomarkers, DDS research materials, photothermal conversion materials, photosensitizers, etc. For example, when a target material adsorbs onto a gold nanorod, the absorption wavelength of the gold particle will shift. Thus, it can be used as a sensing element using changes in spectroscopic characteristics. It can be applied to hyperthermia and ultrasonic echo diagnosis using photoacoustic effects by utilizing the property of heat generation when irradiated with light.

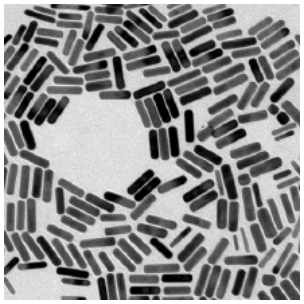

Fig. 1 TEM image of gold nanorods
Source: Nanopartz™, No. A12-40-850
Gold Nanoparticles - Nanopartz™
https://www.nanopartz.com

Method

Apparatus: HORIBA Partica CENTRIFUGE
Measurement mode: Line-start
Samples: Gold nanoparticle/De-ionized (DI) water, Nanopartz™ A12-40-850, Diameter 40 nm, length 148 nm, aspect ratio 3.7
Particle: Gold nanoparticle (Solid concentration: 0.01%, Refractive index: 0.34, Density: 1,932 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: Number based
Calculation setting: QC mode / Custom mode, (none spherical ratio : Prolate 3.7)

Results

The purple particle size distribution in Fig. 2 shows the PSD measured by Partica CENTRIFUGE QC mode with a median diameter of 40.2 nm and mode diameter of 35.8 nm. Since rod-shaped particles such as gold nanorods settle at random orientation, their sedimentation rates are slower than that of spheres, and their particle sizes are smaller. Using the custom mode, selecting “none-spherical correlation”, “Prolate”, and setting 3.7 as the aspect ratio, a recalculation yielded the blue PSD with a median diameter of 43.3 nm and mode diameter of 38.9 nm. It is slightly shifted to the right compared to the original one.

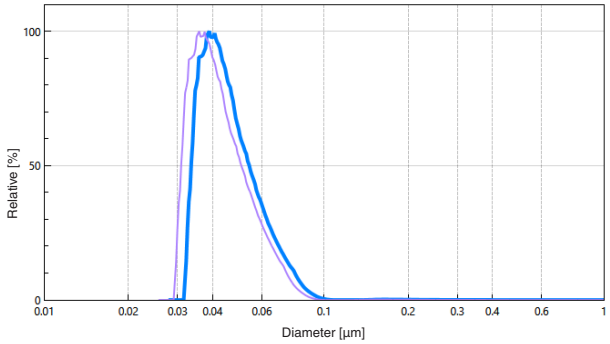

Fig. 2 Number-based PSD

Conclusion

As rod shape was more like the spheroid, prolate was selected for the calculation of the gold nanorods. The centrifugal sedimentation method assumes spherical particles for calculation. If the shape or aspect ratio is known, it can be used for result correction. The shape function allows the selection of prolate and flat, and when the aspect ratio is set, the kinetic resistance coefficient is calculated, and this resistance coefficient is used to compensate for the delay in the settling rate due to the shape.

*Nanopartz is a trademark of Nanopartz Inc.