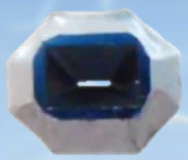
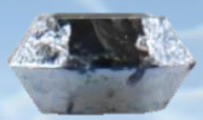
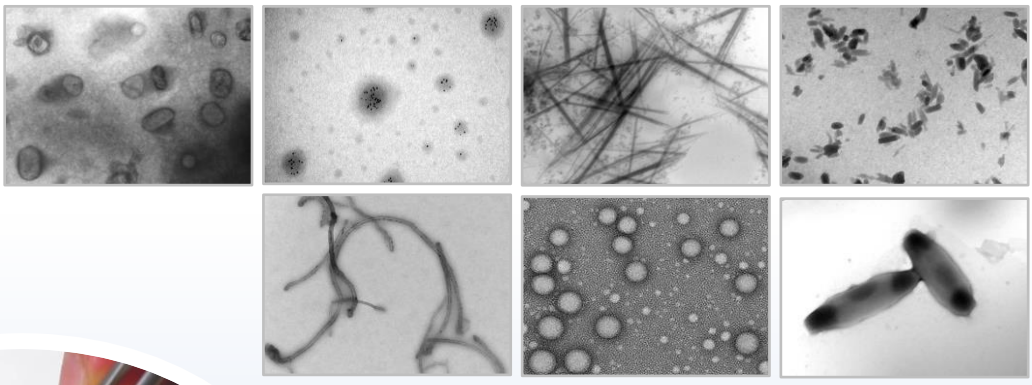
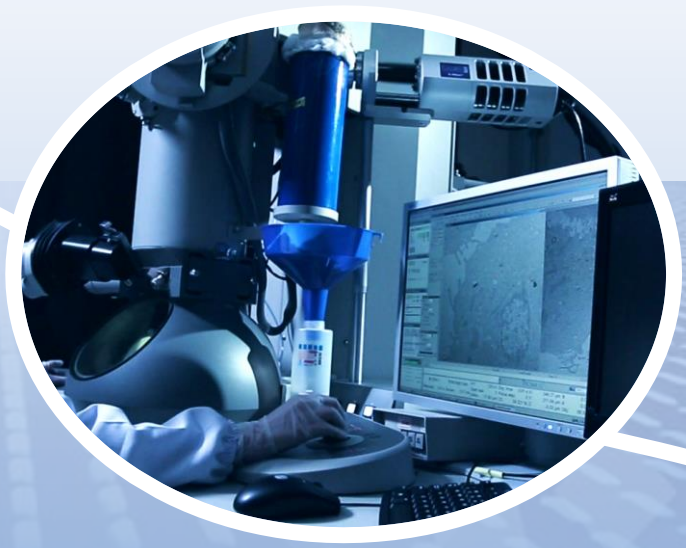
K-kit®

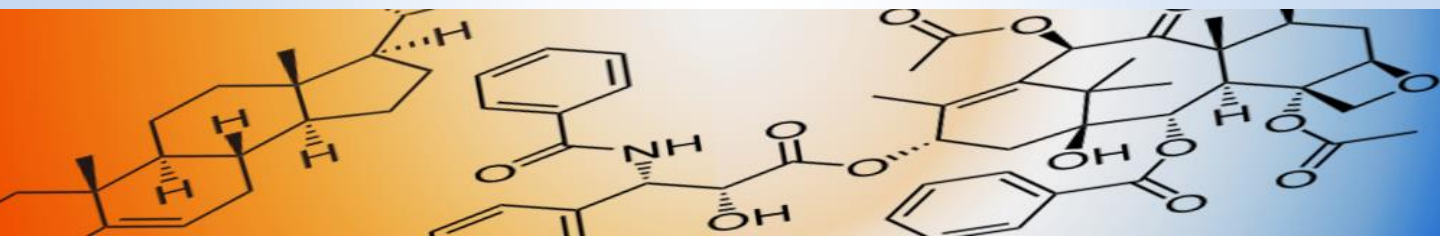




Innovative TEM specimen holder for liquid sample analysis







Materials Analysis Technology Inc.
www.bioma-tek.com

Table of Contents

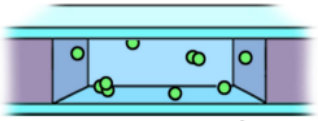
MA-tek's enabling solution for liquid analysis by TEM

K-kit is a single-use sealable carrier with a microchannel inside. It's designed to facilitate convenient TEM and SEM observations of liquid samples, allowing nanoobjects, aggregates, and agglomerates (NOAAs) in liquid samples to be characterized.

K-kit Ø3mm TEM grid

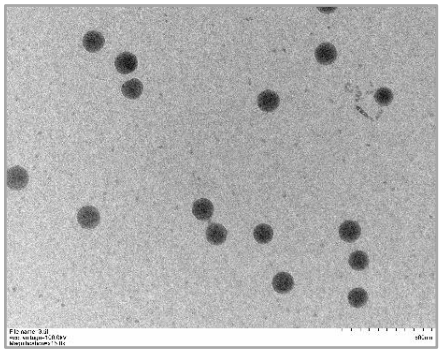
Transmission Electron Microscope (TEM)

Wet



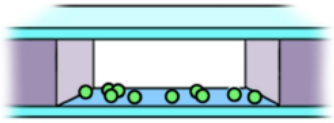
Filled with liquid

- The loaded liquid sample is sealed and imaged using TEM in the native liquid environment.



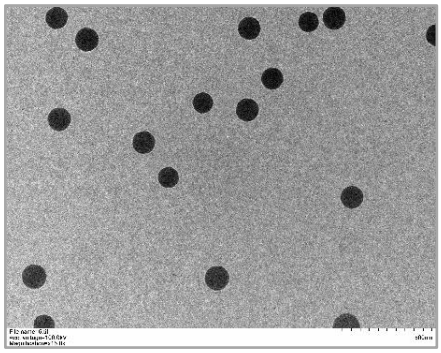
Acceptable image quality

Thin layer



Partially or fully dried

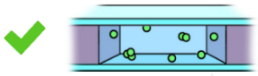
- A patented liquid drying protocol preserves the original morphology and physical state of nanomaterials with improved imaging resolution.

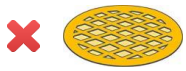


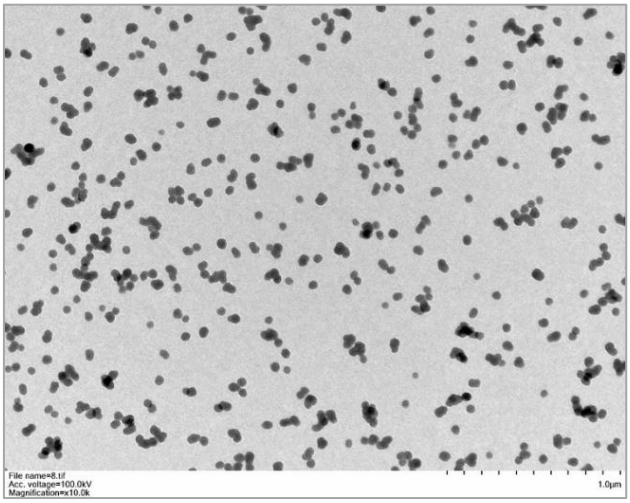
Very good image quality

(NIST 100nm polystyrene spheres)

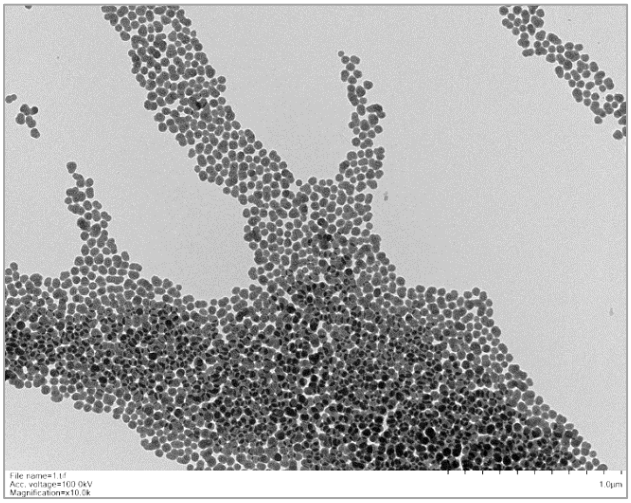
K-kit vs. TEM grid







TEM image of liquid state CMP slurry with K-Kit, enabling individual particles to be clearly identified.



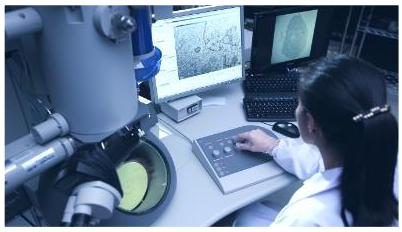
TEM image of dried CMP slurry on Cu grid, unable to be analyzed individual particles due to agglomeration.

(✓ Good Δ Case dependent X Not available)

Physicochemical Parameters	K-kit	Cu grid
1. Composition	✓	✓
2. Size	✓	✓
3. Shape	✓	✓
4. Size distribution	✓	Δ
5. Aggregation and agglomeration in liquid	✓	X
6. Particle concentration	✓	X
7. Liquid TEM observation	✓	X

K-kit adaptability

Compatible with all kinds of TEM holders



Hitachi
H-7501 SS

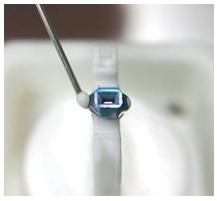
JEOL
EM31640 STHB

FEI
TECNAI F20

Gatan
CT3500HT

If using some types of TEMs like JEOL 2100 which the z-axis focus depth less than ±120um, one will be possibly encountered the out-of-focus issue. In this situation, please refer to the possible solutions as described on our website for it.

Good resistance to most solvents



The following table shows the test results of Torr Seal Epoxy soaked in chemical solvents for 24 hours and then examined using FTIR (if dissolved) and visual observation (if dispersed).

✓- Compatible (FTIR not detected) ▲- Use with care (FTIR detected)

Compatibility (FTIR)	**Water**	**PEG400**	**DMSO**	**Ethanol**	**0.1N HCl**	**0.1N KOH**
	✓	✓	✓	✓	✓	✓
	Toluene	**NMP**	**ACN (CH_3CN)**	**Chloroform ($CHCl_3$)**	**1% NH_4OH**	**0.1N HNO_3**
	✓	✓	✓	✓	✓	✓
	Hexane	**IPA**	**Methanol**	**DCM**	**THF**	**Acetone**
	✓	✓	✓	▲	▲	▲

Material and structural robustness

Broad temperature range for K-Kit -196˚C to 120˚C

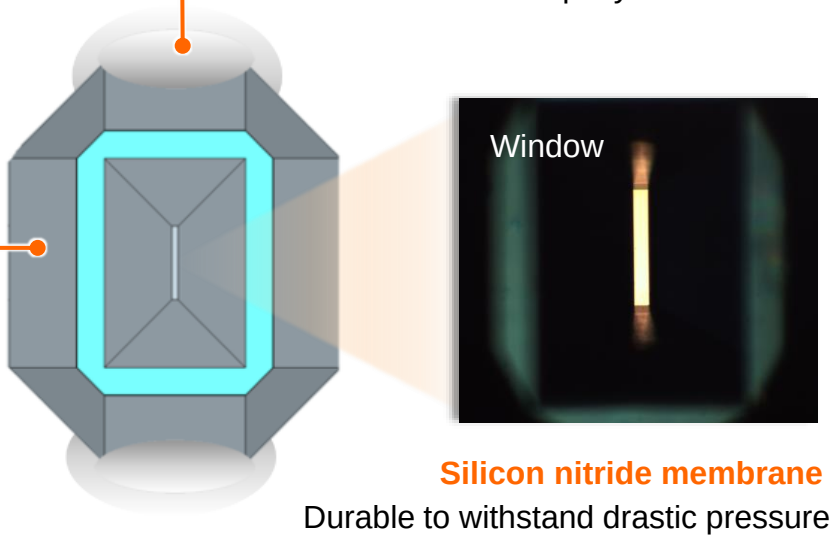
Applicable with heating & cryo TEM holders

Durable Silicon body

(MEMS technology)

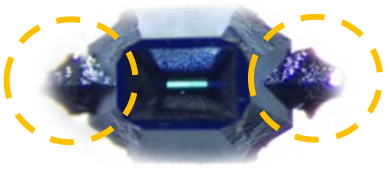
Vacuum compatible glue

Torr Seal® epoxy



Silicon nitride membrane

Durable to withstand drastic pressure changes

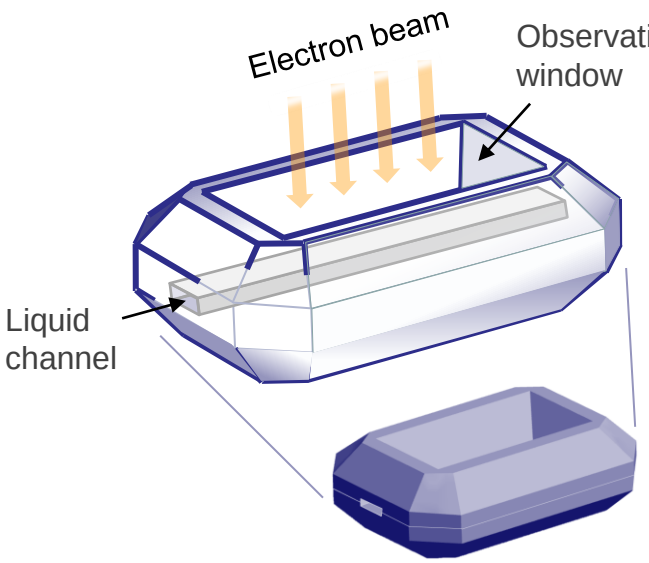


Channel tips

There are channel tips at both ends, to protect the surface condition and cleanness of the channel in K-kit.

Reliable liquid loading

By capillary action, liquid can be loaded in a K-kit reliably, even the viscosity of it up to 3,000 mPa · s.



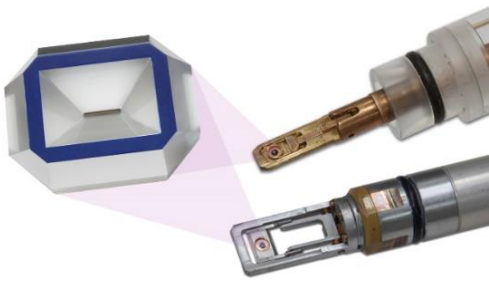
Unibody structure

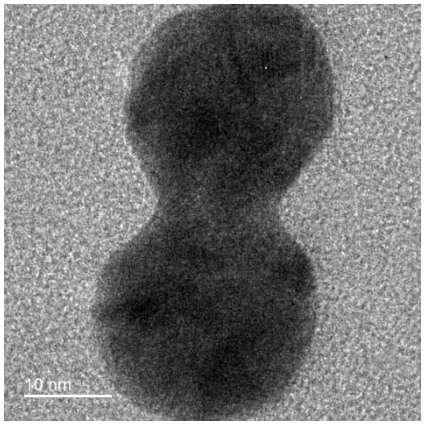
Cross-contamination free (Disposable), no need to do further assembly, surface treatment or pre-cleaning process before the use.

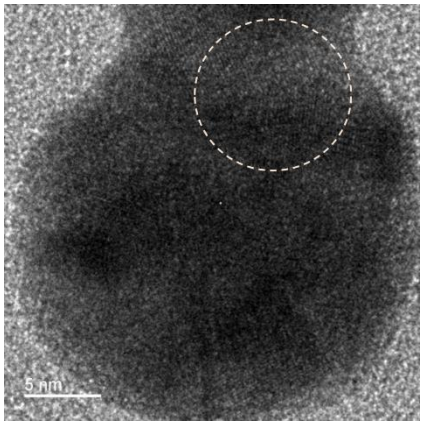
High image quality in TEM

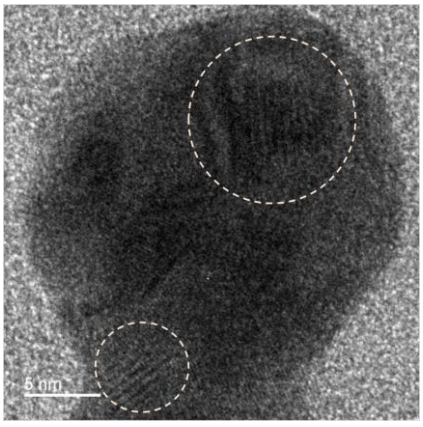
Achievable TEM image resolution by using K-kit

Membrane Thickness of K-kit (Si_3N_4)	Sample Preparation	
	Wet Mode	**Dry Mode**
100nm	< 10nm	< 5nm
30nm	< 5nm	< 2nm

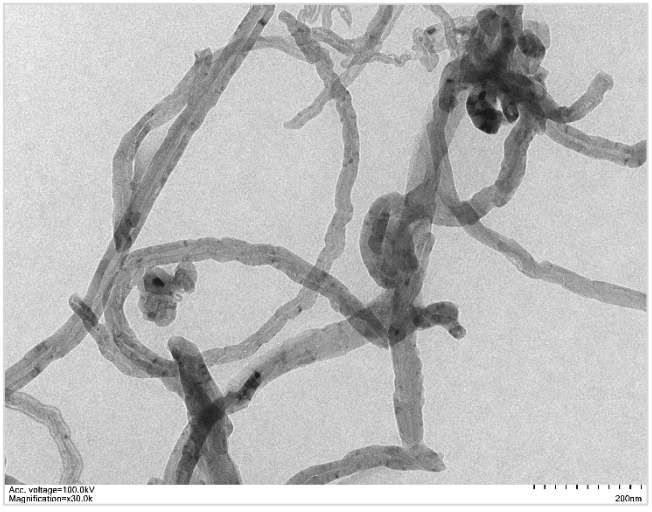


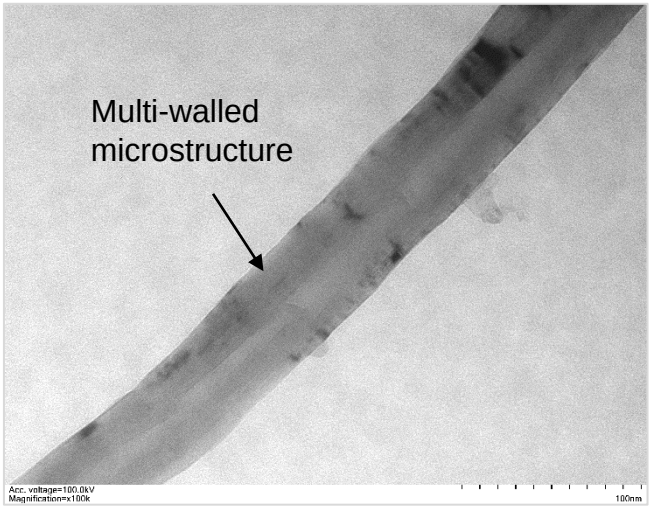






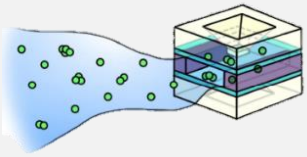
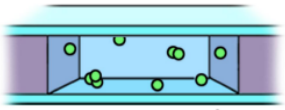
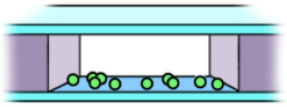
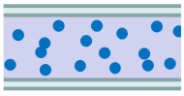
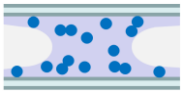
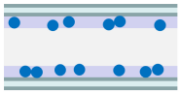
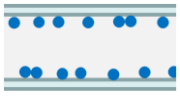
(Example) As shown in the TEM images of gold nanoparticles that formed from reduction process of $AuCl_4$ solution, the lattice lines of gold particles could be clearly observed by using Gap0.2um/ SiN30nm K-kit. (By FEI Talos TEM @ 200KV)

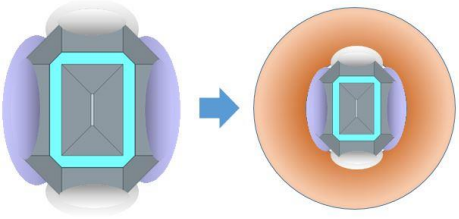




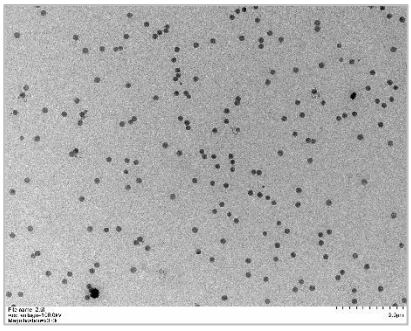
(Example) TEM images of multi-walled carbon nanotubes (WMCNT) that were fully dispersed in water. By using Gap2um/ SiN30nm K-kit, the structures of MWCNTs could be observed clearly. (By Hitachi HT7700 TEM @100KV; WMCNTs: OD 30-80 nm, Length <10 μm, 10wt%)

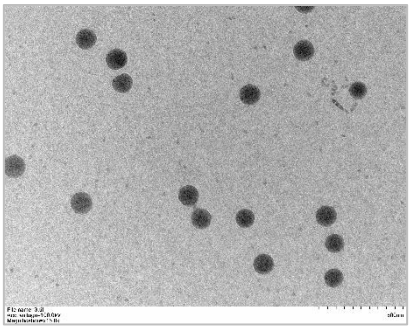
Wet and Thin Layer mode

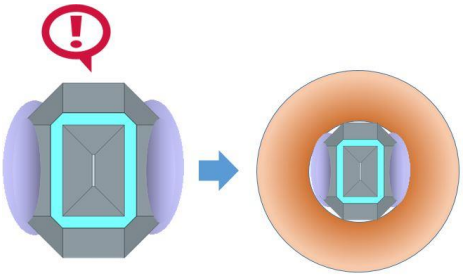
Sample preparation	Wet mode	Thin layer mode
	With Liquid 	Dry 
Imaging resolution	Good	Excellent
Gap height suggested (μm)	**0.1, 0.2, 0.5**	**0.5, 1, 2, 5**
Particle size (Loadable)	1nm～500nm	1nm～3000nm
Particle shape	Keeping original	Potentially, could be deformed.
Chemical reduction or potential damage by electron energy	High	Low
 **Achievable states of K-kit**	 Fully filled  Partially filled	 Thin liquid layer  Dry state



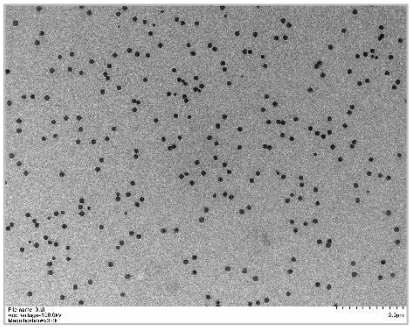
Wet mode

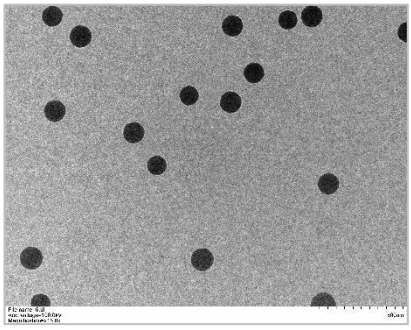






Thin layer mode



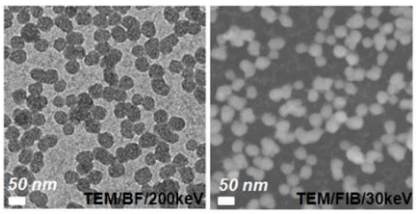


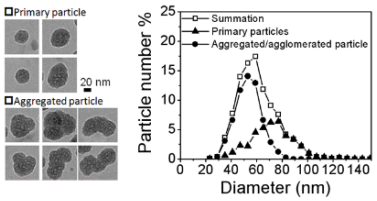
Application markets

Characterize NOAAs in electronics industry, cosmetics, foods, medical devices, and drugs.

Slurry

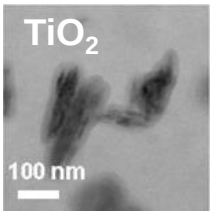
- SiO_2 nanoparticles in CMP slurry

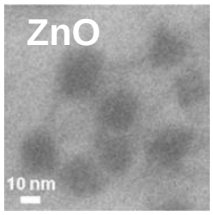


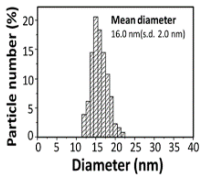


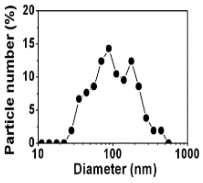
Lotion

- TiO_2 and ZnO nanoparticles in sunscreen









Electronic

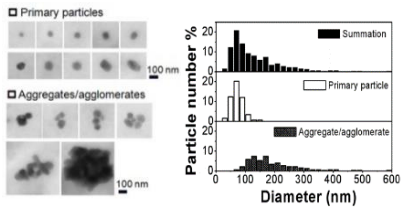
Cosmetics

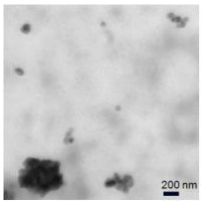
Foods

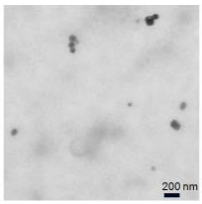
Drugs

Beverage

- $CaCO_3$ nanoparticles in milk

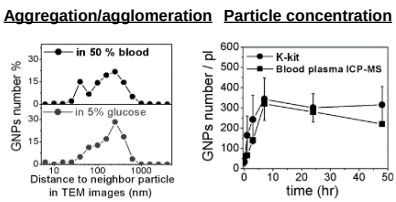


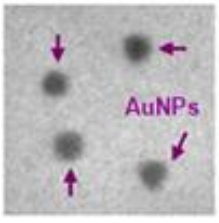


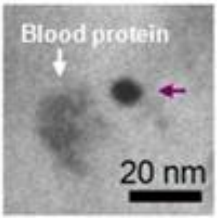


Bio Sample

- Au nanoparticles in blood





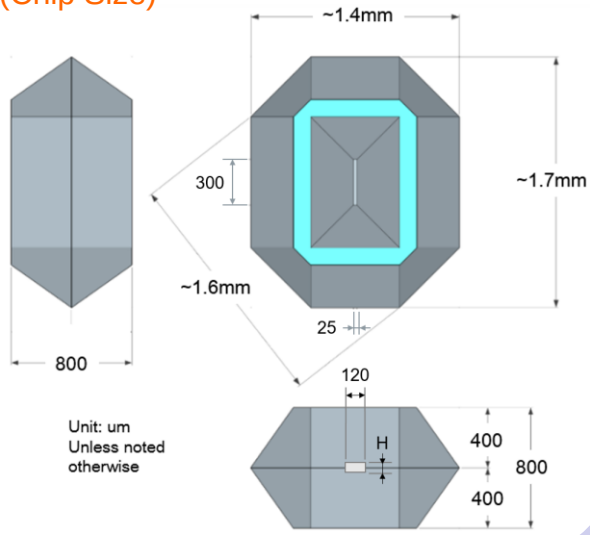


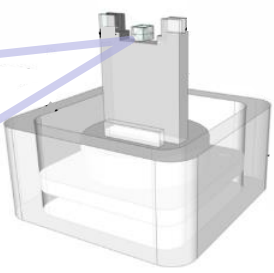
Reference：

1. US FDA 2012, Guidance for Industry – Safety of Nanomaterials in Cosmetic Products.
2. EU/JRC July 2012, Requirements on Measurements for the Implementation of the European Commission Definition of the Term “Nanomaterials”.
3. ISO/TR13014: 2012, Nanotechnologies -- Guidance on physico-chemical characterization of engineered nanoscale materials for toxicologic assessment.
4. ICCR 2012, Characterization of Nanomaterials II - Insolubility, Biopersistence and Size Measurement in Complex Media.

Shipping packages and tool sets

(Chip Size)



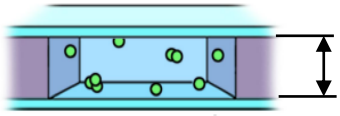


(K-kit carrier)

Each carrier has a K-kit attached on top

Protected with a clear cap. (A copper grid is enclosed at the bottom of the carrier.)

- Window length $300\ \mu m$, Width $25\ \mu m$
- Channel height (H):
  0.2 and 2.0 standard
  0.1, 0.5, 1.0 and 5.0 available



H = 0.1, 0.2, 0.5, 1, 2, 5 (μm)

4 K-kits

6 K-kits

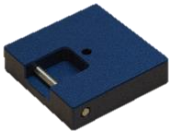
(Shipping packages)

Copper grid

Channel opener

Starter box (glues, needles, channel opener, etc.)

(Tool sets and consumables)



Sample-loading stage

K-kit gluing stand

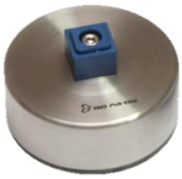
K-kit holder

Needle pen

K-kit tool box

Tool box, we offer a full tool set, including K-kit holder, sample-loading stage, needle pen, K-kit gluing stand, recommended glues, glass slides and some replacement parts.

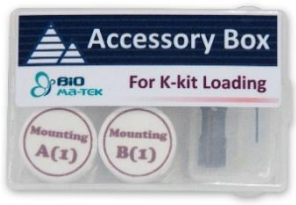
W275 x D150 x H50 (mm)



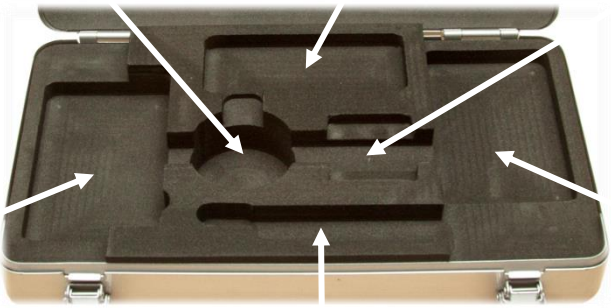
K-kit gluing stand

Glass-slide pack

Sample-loading stage



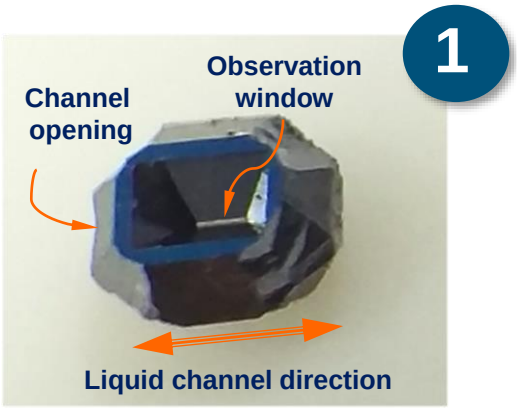
Accessory Box



K-kit holder & needle pen

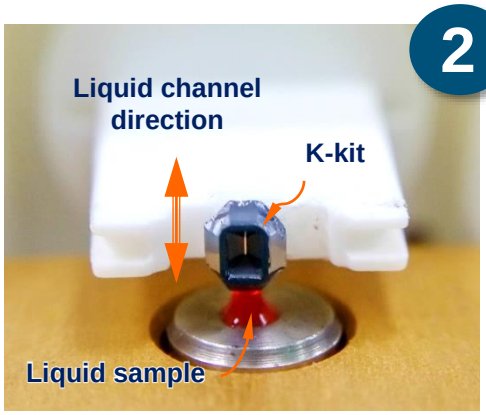
K-kit shipping package (without K-kits)

Sample preparation procedure



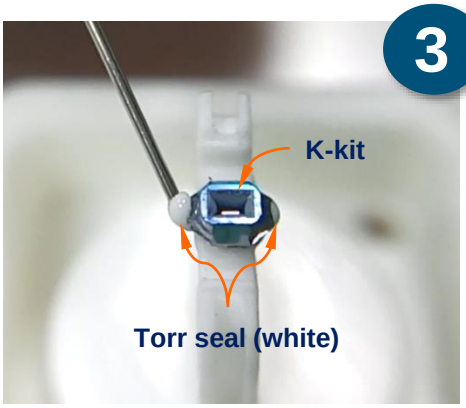
1.K-kit:

K-kits are Si-based microchannel devices with silicon nitride windows that allow SEM, FIB, STEM, and TEM observations. The shape is a result of anisotropic wet etching. The liquid channel is parallel to the window, with openings at both sides.



2.Filling:

Liquid fills the channel through capillary force. The liquid surface is “pulled up” by the K-kit. Keep the K-kit steady for approximately 1 min to allow the filling to complete. The aqueous liquid sample should be placed on a glass slide. Both the K-kit and glass surface are hygroscopic. Do not immerse the K-kit in liquid to prevent from the window being contaminated.

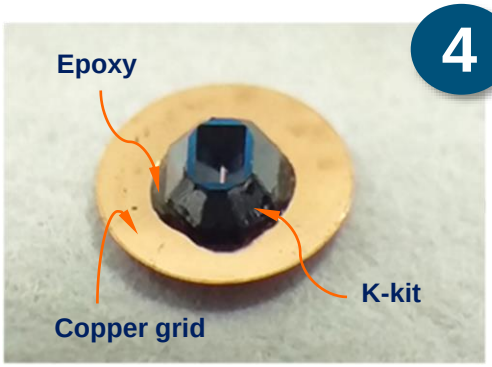


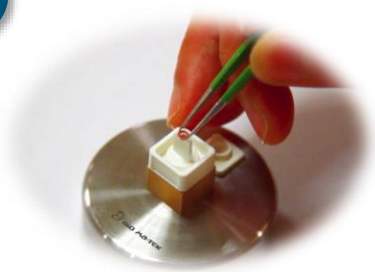
3. Torr-seal:

Cover the channel openings at both ends with Torr Seal epoxy after filling the device with liquid. (No need to do this gluing step, if one would like to dry out the liquid and leave the nanoparticles a Thin Layer mode in K-kit.)

4. Copper grid:

Use epoxy to mount the sealed K-kit to a copper grid by fitting it to the precut hole at the center of the grid.





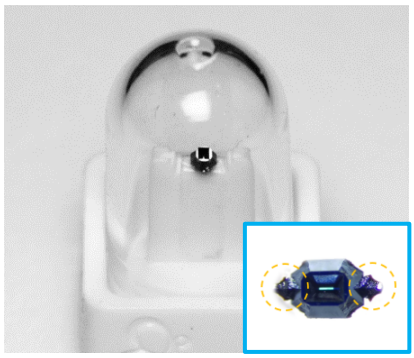
QR code link to demo video

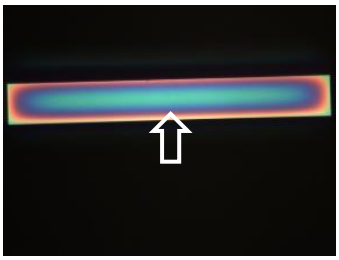
If on-line, please click the link to watch demo video: https://youtu.be/Hi9TyT4MwEg

Matters needing attention when using K-kit

Inspection before use

- With color rings on the membrane
- No any damage to the structure

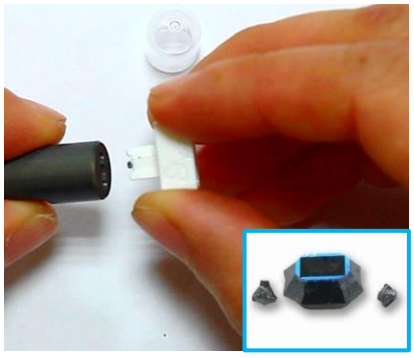


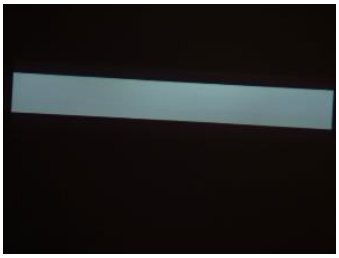


With Newton's rings
(Sealed by channel tips)

Channel tips removal

- No color patterns on the film
- Liquid should be loaded in 30 minutes after removing the channel tips.

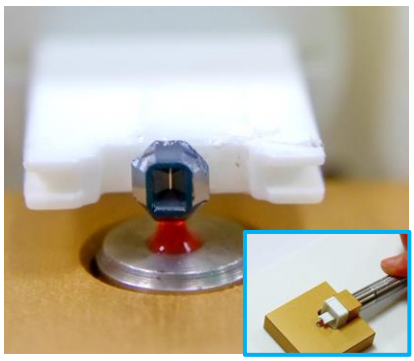


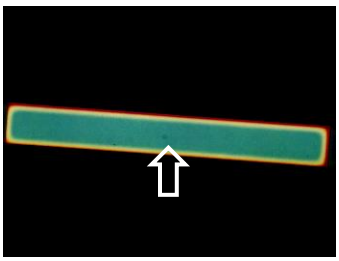


Flat membrane
(Open to atmosphere)

Liquid loading

- Keep K-kit steadily touching on liquid surface at least for 30 seconds.
- Do not immerse K-kit in the liquid.

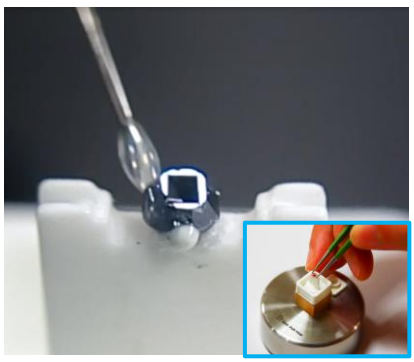


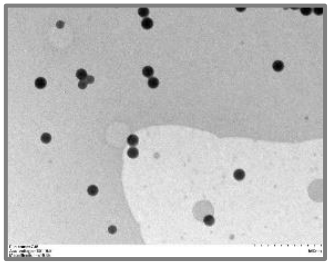


With color patterns
(There's liquid filled)

Gluing process

- Glue the both ends of K-kit in 60 seconds after liquid loading.
- Do not glue off the K-kit, if making it with Dry mode.
- Glue with care, to avoid any adhesive flowing into the cavity.

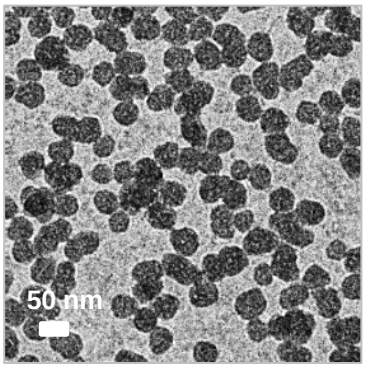




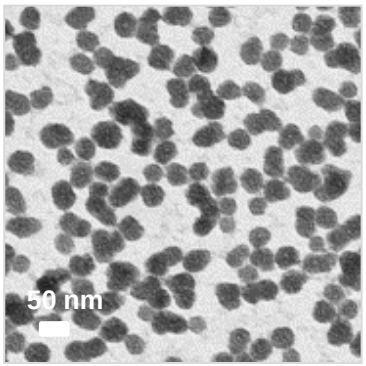
Liquid well reserved
(Quickly to glue the K-kit)

Available for TEM and SEM observations

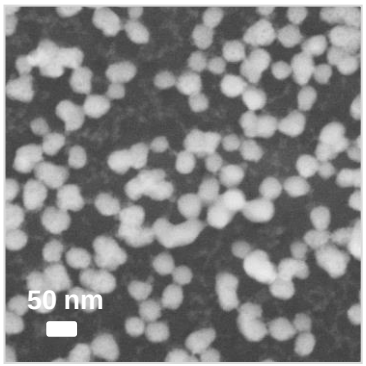
Compatible to versatile microscopy analyses



FEI-TEM @200Kev



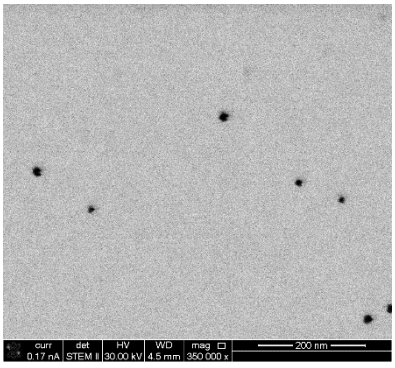
Hitachi-TEM @100Kev



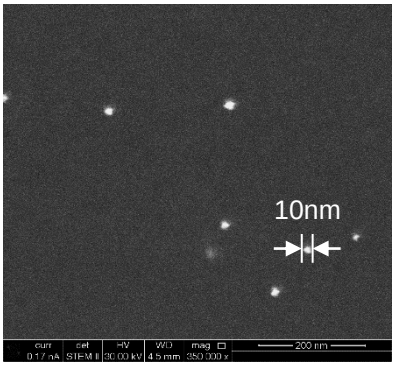
FEI-STEM @30Kev

High imaging quality in SEM

Gold nanoparticles with sizes less than 10nm also could be clearly imaged with SEM.

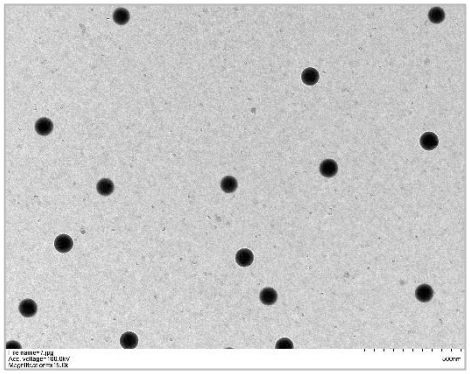
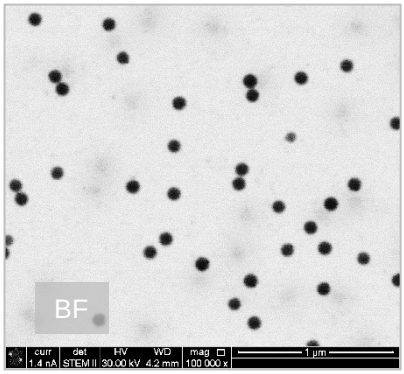
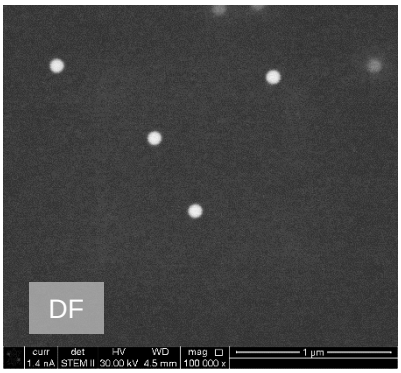


Bright Field (BF)



Dark Field (DF)

☐ The comparison results of TEM and FIB-SEM images (Polystyrene beads in K-kit)

Hitachi HT7700 **TEM**	FEI Helios 400 **FIB-SEM**
	 

Multiple loadings and negative staining

K-kit can provide researchers with faster and better choices when using a TEM to examine nanogranules of biological specimens in aqueous conditions.

Multiple loadings

With an unibody structure, K-kit can be used on multiple-loading applications, e.g. immunoelectron microscopy or catalyst chemistry studies etc.

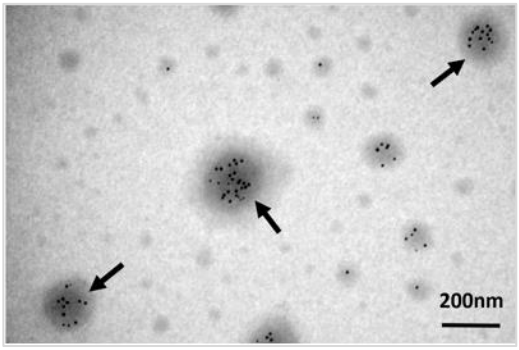
1st K-kit loading with liquid A

Prepared in dry mode for liquid A

2nd K-kit loading with liquid B

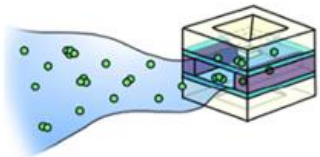
Prepared in dry or wet mode again for liquid B

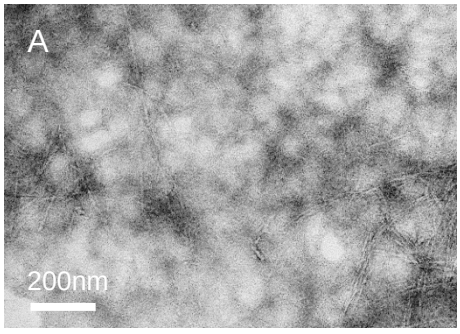
(Example) The presence of specific platelet granules could be labelled and observed by using a K-kit with multiple loadings. After some necessary pre-treatments and washings, the platelet sample in K-kit was incubated with the primary antibody (mouse monoclonal anti-P-selectin antibody) and next was reacted with a secondary antibody (6-nm gold-conjugated goat anti-mouse IgG antibody) for 2h at 37˚C, and then the K-kit was sealed and examined in TEM. *(Appl. Sci. 2020, 10, 4946)*



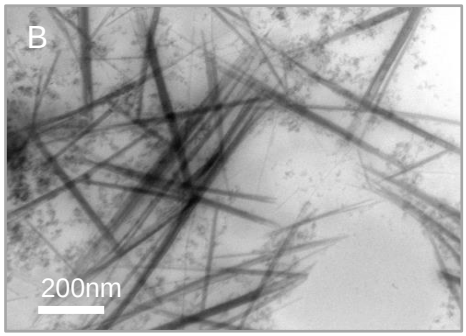
Immunoelectron micrographs of isolated platelet granules in a K-kit.

Negative staining





On Cu grid (In dry state)



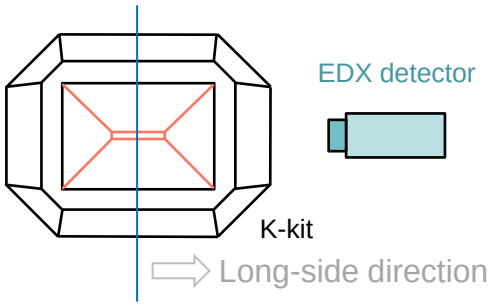
In K-kit (With liquid).

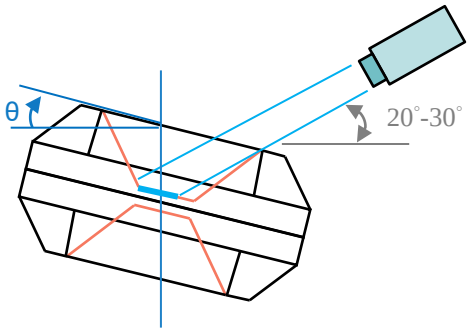
(Example) Negative staining TEM images of collagen on Cu grid and in K-kit. As shown in Fig. B, the collagen nanofibers could be clearly observed by using a wet-mode K-kit.

Available for EDX analysis

How to make EDX analysis achievable on a K-kit

- In a TEM, an EDX detector is usually located at an angle of around 10 - 20º with regard to the sample; X-ray signals excited from the observation window of a K-kit will be easily blocked by that deep cavity. If so, by pointing the window long side of the K-kit toward the EDX detector along with tilting the TEM holder at some angles over 15º, which can make the EDX analysis achievable on it.

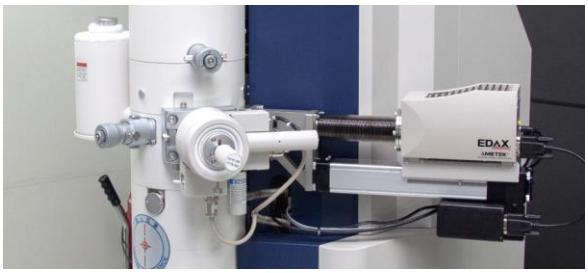


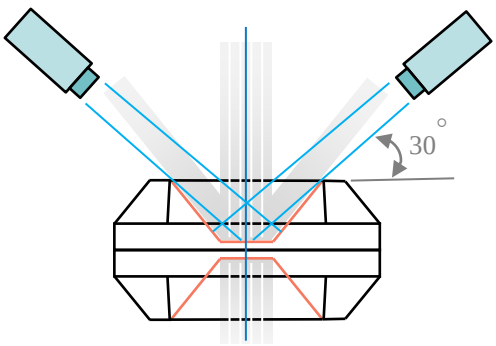


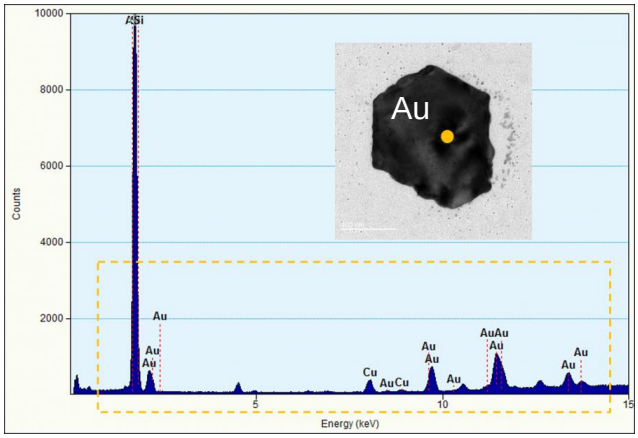
1 Align the window long side of K-kit to point to the EDX detector

2 Give a tilt at least of 15˚ toward the EDX detector

- For some modern TEMs that installed with multiple EDX detectors or only a detector but at a larger angle to the sample, one usually can get EDX signals from a K-kit directly without any tilting or rotation on the TEM holder.

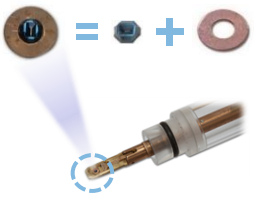






K-kit vs. in-situ TEM holder

K-kit can be the most convenient option in the market for liquid-TEM observation.



Around 90min required for 10 samples

Liquid loading and gluing for 10 K-kits (～70min) + vacuum pumping (～20min)

450min at least for 10 samples

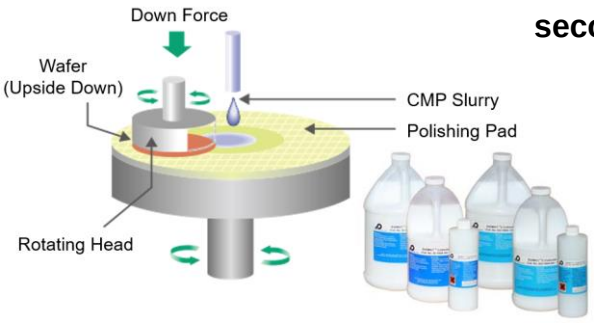
One by one; it needs the steps including surface treatment, assembly, leakage detection, and post-clean etc. for one sample. (> 45min for each)

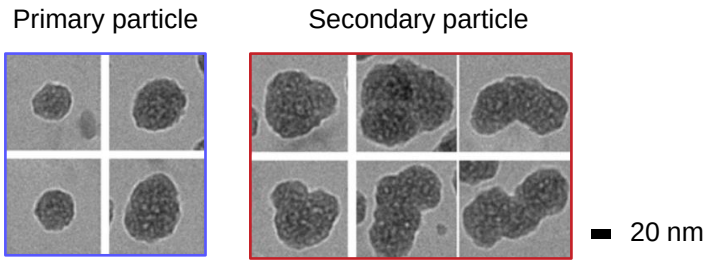
Product	K-kit	In-situ TEM holder
Cell size	1.7mm x 1.4mm (Fit in with Ø3 mm grids)	> 2.4mm x 2.4mm
Custom holder	No need	Required
Price	≤ US$200	~ US$100,000
Competitiveness	• Simple, quick and affordable • Compatible to all TEM holders • Available for SEM observation • Good resistance to chemical solvents • Cross-contamination free (Disposable) • Achievable to quantitative analysis • Reliable loading with viscous liquids • Broad temperature range -196°C to 120°C	Available for flowing and electrochemical studies
Weakness	• Only for static liquid analysis • Electrodeless design	• Sky-high prices • Further pre-clean and assembly processes required • With the risk of liquid leakage in TEM • Dedicated for specific TEMs
User base	Industry and academia	Only for academia

Example

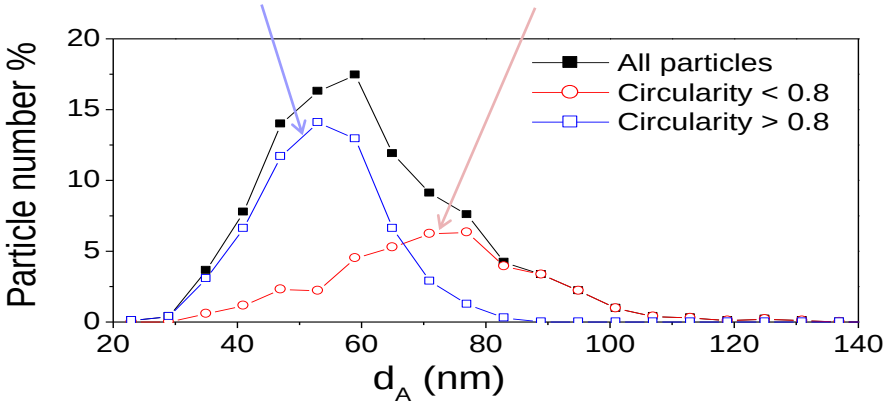
NOAAs of abrasives in CMP slurry

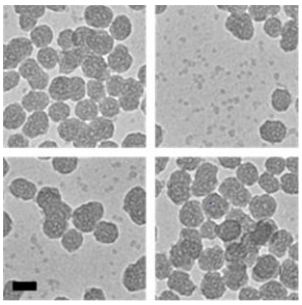
K-kit can be used for characterizing the primary and secondary particles in undiluted CMP slurry.





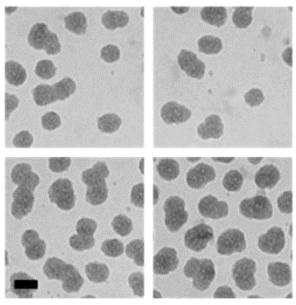
- Composition
- Size/size distribution
- Shape
- Aggregation state
- Surface



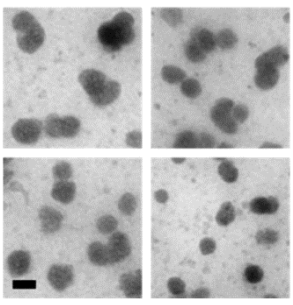


Dried on copper grid

* Scale bar is 50 nm

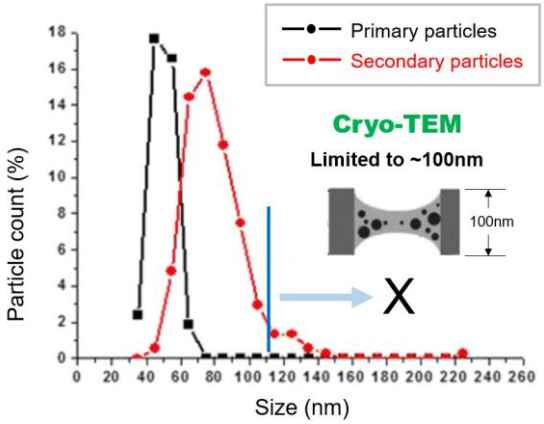


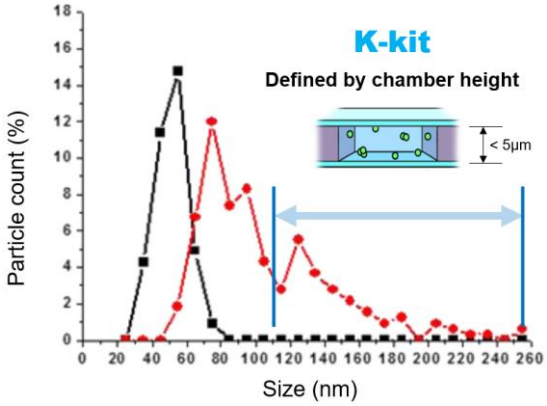
Frozen in Cryo-TEM grid



In liquid phase in K-kit

K-kit allows board size range of particles to be analyzed.

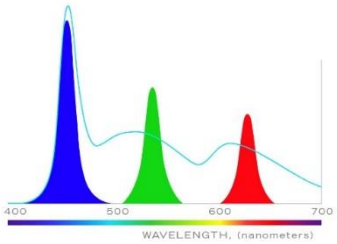


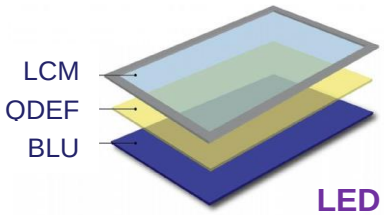


Example

NOAAs of quantum dots in solution

Quantum dots will enable a market for devices and components over $11bn by 2026.

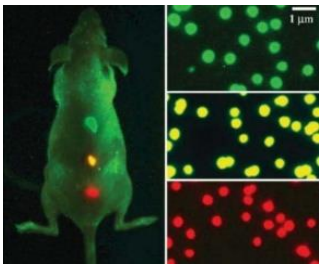




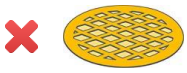
- QD: Quantum Dots
- BLU: Backlight Unit
- LCM: Liquid Crystal Module
- QDEF: Quantum-dot Enhancement Film

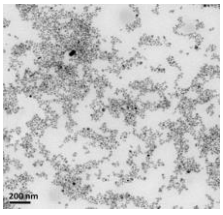
LED display

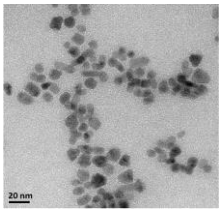
QD inks for printed electronics



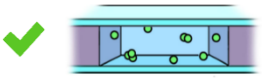
QD imaging diagnosis

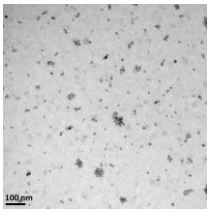


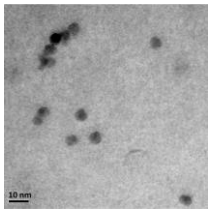




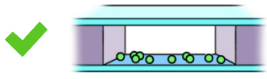
QDs dried on copper grid

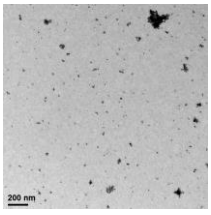


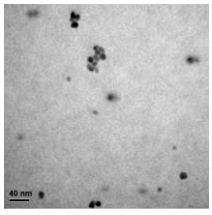




Wet mode of K-kit

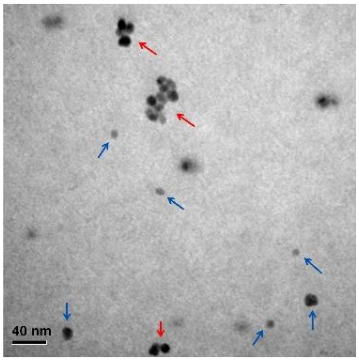


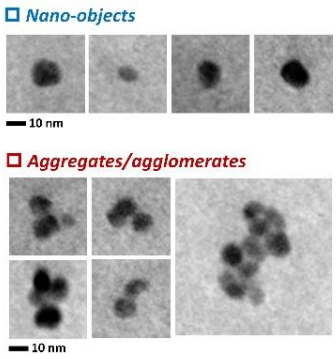


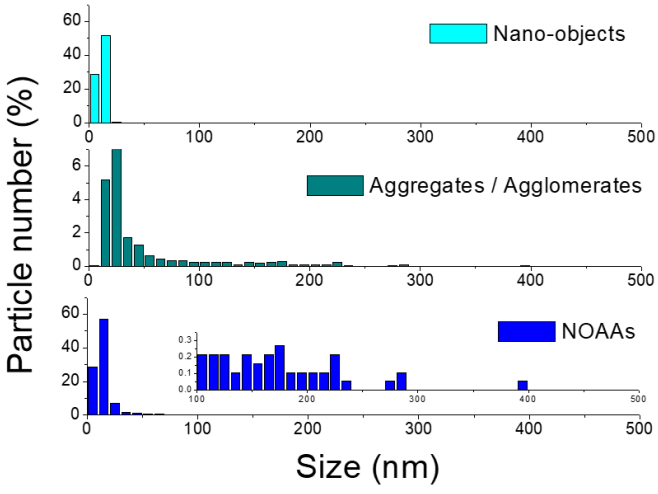


Thin Layer mode of K-kit

K-kit enabled, TEM images and size and size distribution of QDs in chloroform





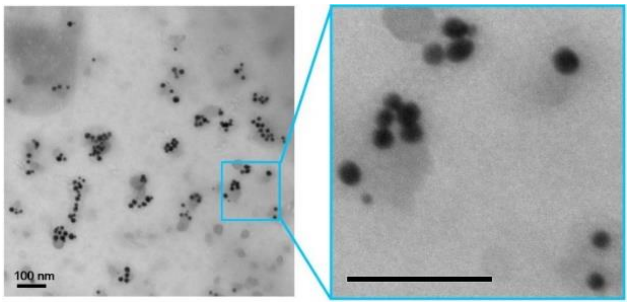


- Sample solution was directly loaded into K-kit
- Nano-objects = Primary particle
- Aggregates/agglomerates = Secondary particle

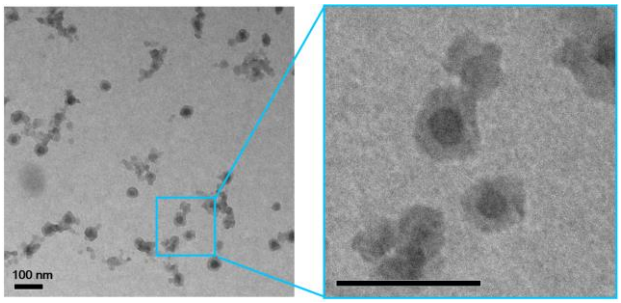
Example

Drug particles in Nanopharmaceuticals

K-kit can be used for characterizing drug particles in Nanopharmaceuticals by imaging the particle morphology, size and size distribution, to evaluate drug formulation or conduct any bioequivalence study.



AuroVist® solution was directly loaded and sealed in a K-kit in liquid form.



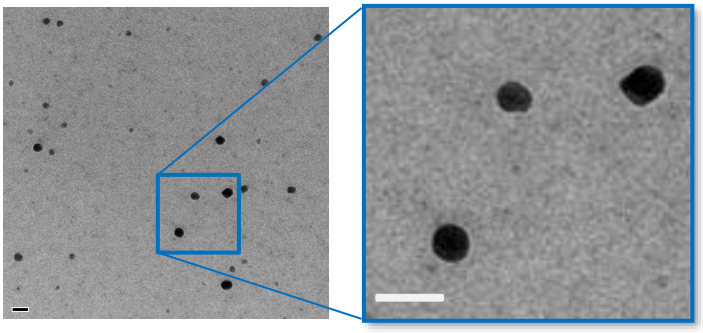
Oil emulsion in water was loaded and sealed in a K-kit in liquid form.

K-kit enabled, TEM images and size and size distribution of Abraxane in saline

Paclitaxel

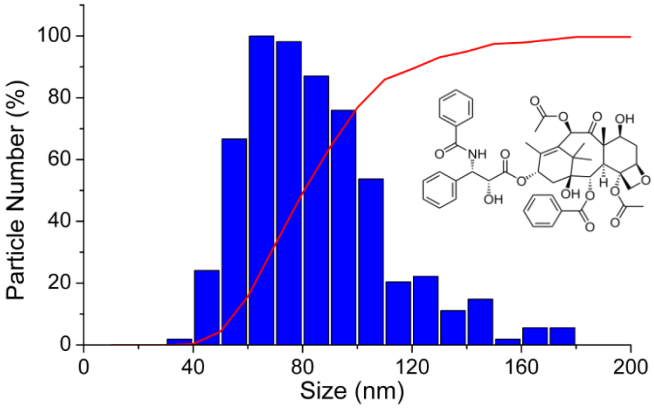
Albumin

Protein particles in Abraxane®

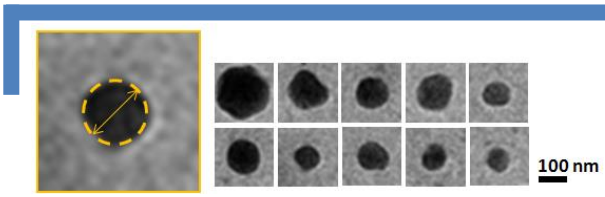


** Scale bar: 200 nm*

- Total calculated particle #: 319
- Average size: 85.1 nm
- Standard deviation: 27.0 nm



Size/size distribution (D10 , D50 , D90)



Parameter	Size (nm)
D 10	55.6
D 50	80.1
D 90	122.2
Span: (D_{90} - D_{10}) / D_{50}	0.831

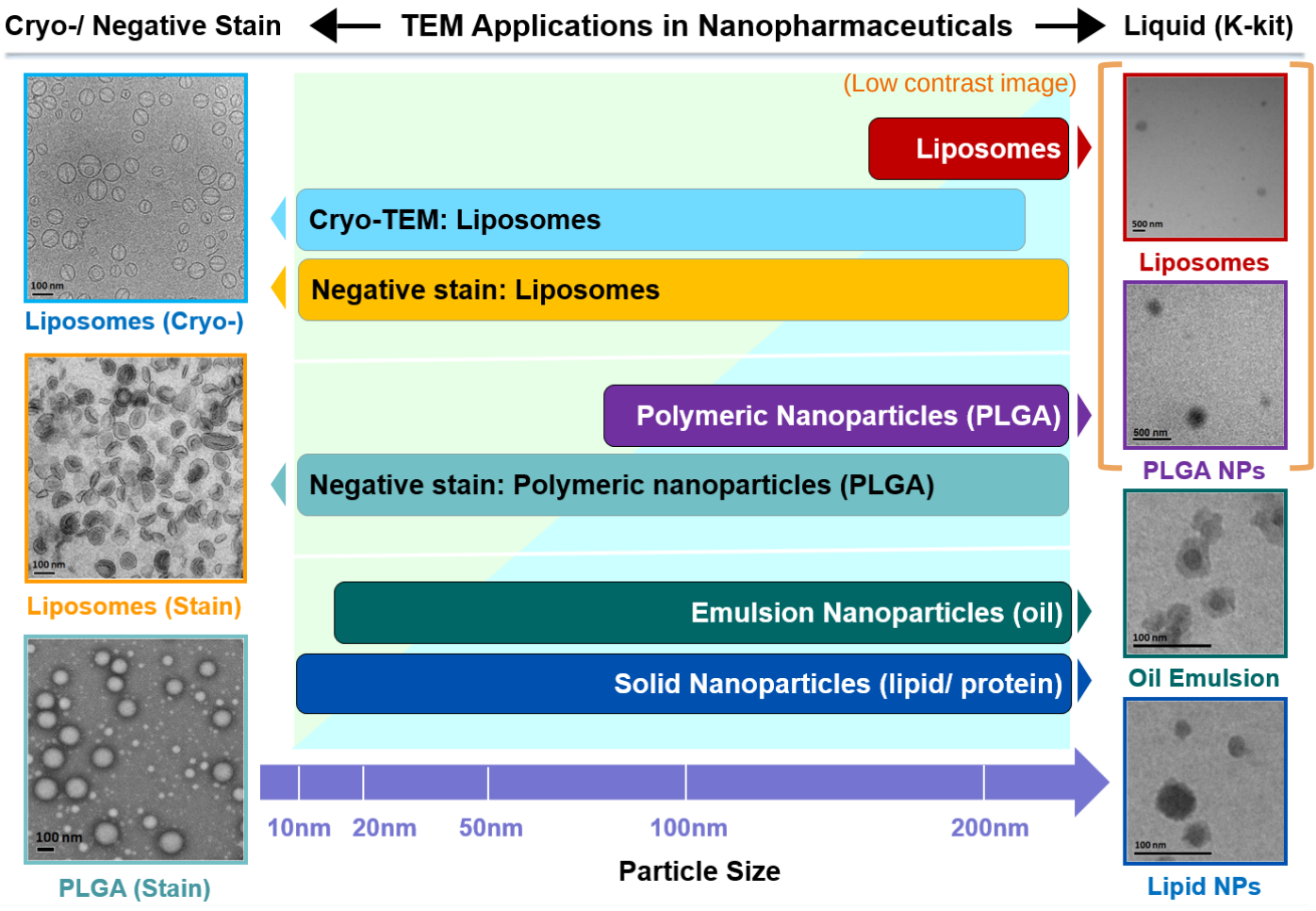
K-kit is the best option for Nanopharmaceuticals

◆ **Applicable particle concentration for K-kit: 10^{11}~10^{14} particles/ml**

The particle concentrations of most nano-drugs fall in the applicable range for K-kit. So, they can be directly observed and analyzed by using K-kit, without any dilution or condensation.

Brand Name of Pharmaceuticals	**Doxil ®** **(1995 approved)**	**Abraxane ®** **(2005 approved)**	**Aurimune ®** **(Phase II)**	**Resovist ®**	**Rexin-G ®** **(Phase II)**
Particle Size	80-100 nm	~ 130 nm	~ 27 nm (AuNPs core), ~ 30-40 nm as hydrated	~ 45-60 nm (Hydradynamic diameter)	~ 100 nm
Particle Concentrations	1.0 x 10^{14} liposome /ml	4.3 x 10^{13} albumin particles /ml	≦ 1.7 x 10^{12} gold particles /ml	1 x 10^{14} particles /ml	1-4 x10^{11} cfu

◆ **The availability of K-kit compared with other solutions**



Some bio-samples with very low contrast in TEM (like liposomes or PLGAs) that also can be clearly observed by using K-kits with negative staining.

Example

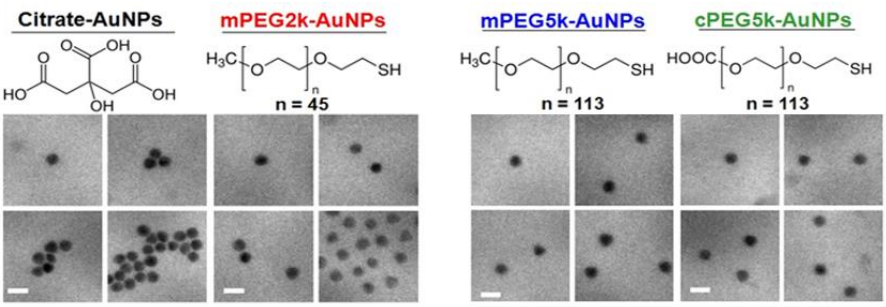
Quantitative characterization of nanoparticles in blood

Quantifying the concentration of nanoparticles in a biological matrix is important for in vivo analysis of their absorption, distribution, metabolism, and excretion, as well as for pharmacokinetic and toxicity studies. In this study, we demonstrated the possibility of using K-kit to obtain the aggregation and agglomeration states of nanomaterials in various native environments of interest.

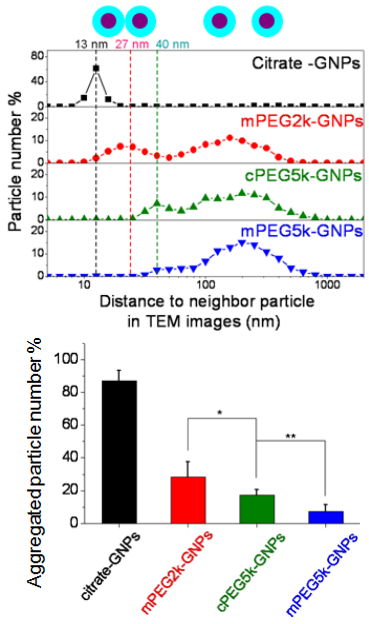
(Tai et al. Anal. Chem. 2012, 84: 6312-6316)

◆ Observation of different PEGylated gold nanoparticles in diluted blood with K-kits

	Particle size			Surface properties		In 50 % Blood
	TEM [a]	DLS [b]		Zeta potential [b]	Surface ligand density [c]	Aggregation extents
Samples	d (nm)	d (nm)	PDI	ξ(mV)	PEG (#/nm^2)	Aggregates (%)
Citrate-AuNPs	13.0±0.9	14.6	0.083	-28.3	non	87.1±6.2
mPEG2k-AuNPs	27.5±2.2	29.5	0.144	-23.0	2.27	28.4±9.2
mPEG5k-AuNPs	39.9±2.8	39.6	0.071	-18.9	1.63	7.1±3.9
cPEG5k-AuNPs	39.6±3.0	39.3	0.093	-35.5	0.82	17.3±3.4

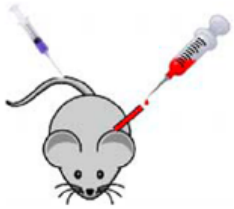


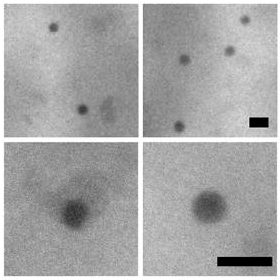
(TEM images of PEGylated gold nanoparticles in the 50% diluted blood)



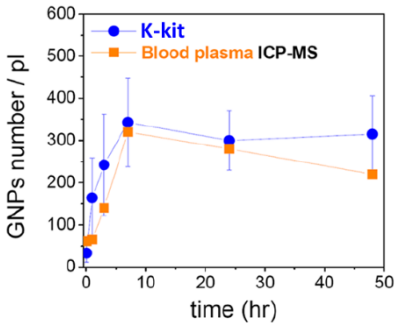
The observation results demonstrated a high trend consistency on aggregation extent with the reference characterization information as listed in the table.

◆ Quantification of the cPEG5k-GNP concentration in blood samples using K-kit and ICPMS analyses





* Scale bar: 20nm



This study showed the comparable results obtained for the number of cPEG5k-GNPs counted in the K-kit and measured by ICPMS. It confirmed that K-kit is a simple and convenient sampling device for evaluating the concentration of nanoparticles using TEM.

Example

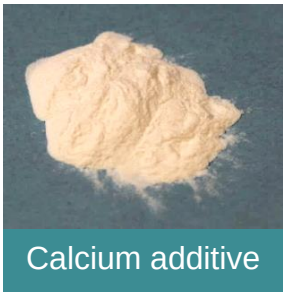
NOAAs of $CaCO_3$ NPs in milk

K-kit can be used for characterizing nanoobjects of foods in final product form, to evaluate the safety risks of nanomaterials in food additives and in substances in contact with foods.

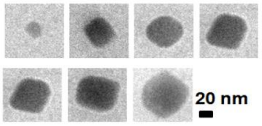
Comprehensive physicochemical characterization

Parameter	Results	Methods
1 Composition	Calcite $CaCO_3$	TEM/EDX, XRD
2 Size / size distribution	Average Diameter / Standard deviation	
Crystal particle size	36 / 4 nm	XRD
Primary particle size	73 / 26 nm	TEM
Powder size	17 / 10 μm	SEM
3 Shape	Cubic	TEM
4 Aggregation/Agglomeration		
in relevant media	Average diameter / Standard deviation	K-Kit / TEM
NOAAs	115 / 73 nm	(4wt% in DI water)
Nano-Objects	68 / 20 nm (number 58%)	
Aggregations / Agglomerations	180 / 70 nm (number 42%)	
5 Solubility/Dispersibility	< 0.01% in Ca^{2+} form	ICP/MS
	Dispersed in DI water > 4 wt%	K-Kit / TEM
	(20 ~ 450 nm)	
6 Surface charge	-23.4 ± 1.3 mV (in DI water)	Zeta potential
7 Surface chemistry	Surface atom:	XPS
	C (35%), O(48%), Ca(16%)	
8 Specific surface area	18.14 m^2/g	BET

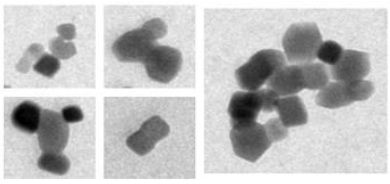
◆ **Raw material ($CaCO_3$ powder)**



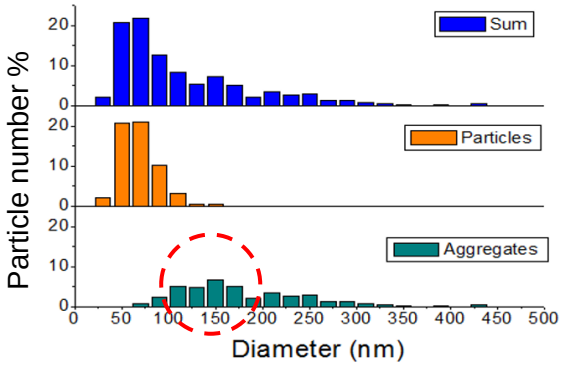
☐ NOs (Nano-objects)



☐ AAs (Aggregate/Agglomerate)

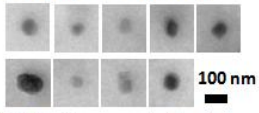


(4 wt% in DI water)

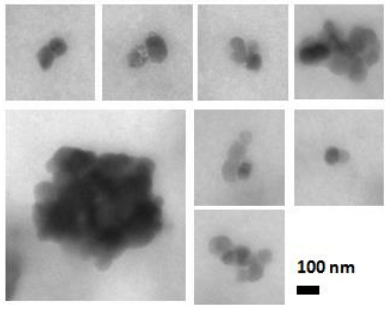


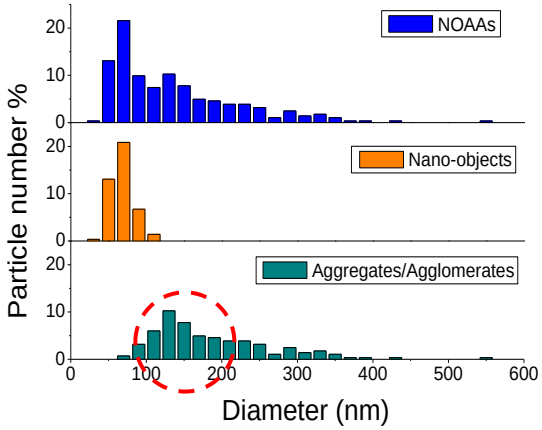
◆ **Final Product (Milk)**

☐ NOs (Nano-objects)



☐ AAs (Aggregate/Agglomerate)





The aggregation extents of calcium granules might be slightly different between the raw additive and product form.

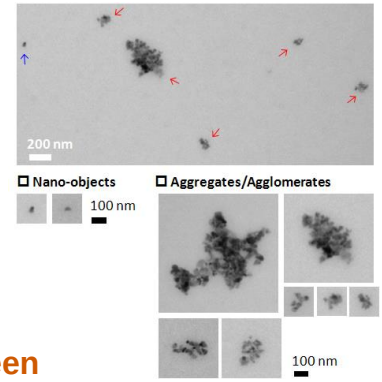
Example

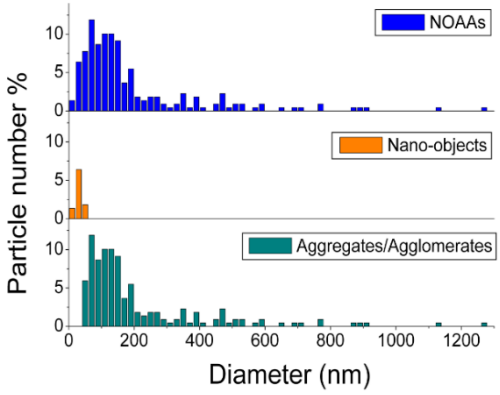
NOAAs of ZnO NPs in sunscreen

K-kit can be used for characterizing NOAAs of cosmetics in final product forms, including lotion, cream, and powder, to assess the safety risks of nanomaterials in cosmetic ingredients.

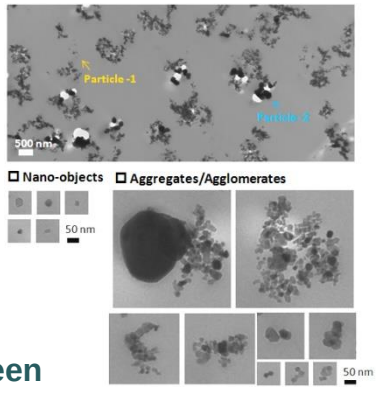
◆ **Regulations and regulatory trends for nanomaterials on cosmetics**

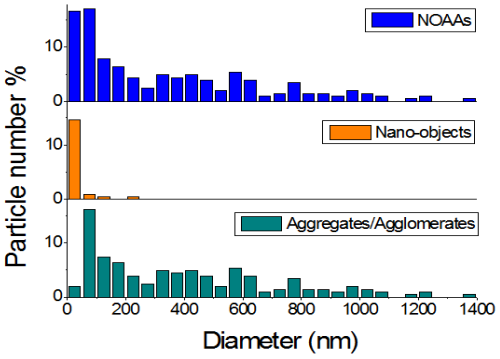
- **International Cooperation on Cosmetic Regulation Report (ICCR) 2012**
  Characterization of Nanomaterials II – Insolubility, Biopersistence and Size Measurement in Complex Media.
- **European Union (EU) Cosmetics Regulatory (EC) No. 1223/2009**
  Mandatory labeling of Nanomaterials as Ingredients in Cosmetics (Effective 2013/07/11)
- **United States Food and Drug Administration Guidance (US FDA) 2012**
  Guidance of Industry - Safety of Nanomaterials in Cosmetic Products





ZnO **NOAAs in sunscreen**

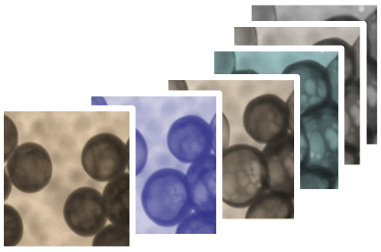




TiO_2 **NOAAs in sunscreen**

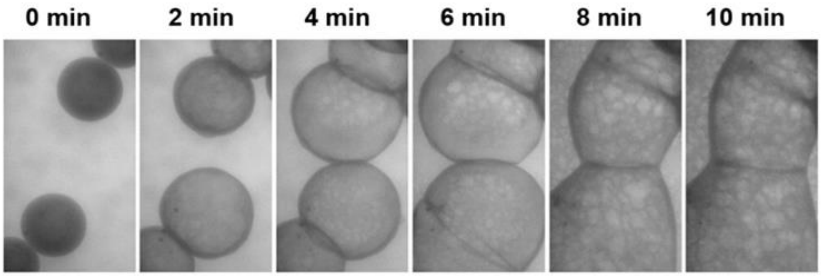
Example

In-situ dynamic observations of NOAAs in liquid

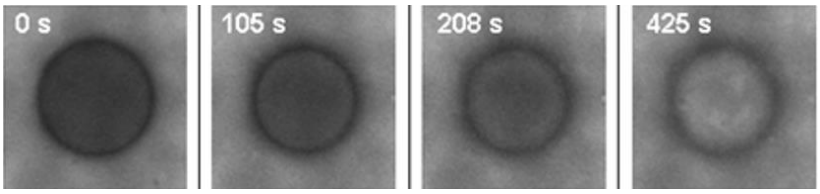


The in-situ changes of nanomaterials can be observed and studied with K-kit dynamically, by a variation with time, area, temperature or surroundings.

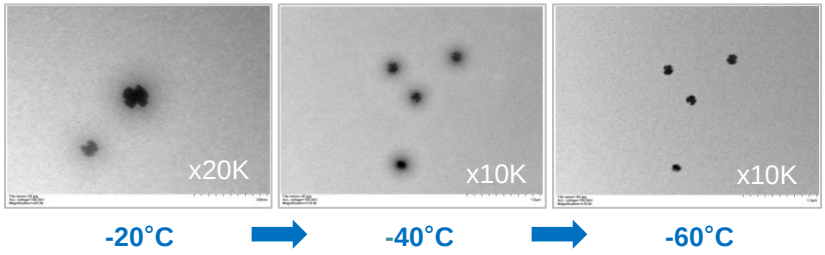
**Exposed electron (100 keV, 4 X 10^4 A/m^2)*



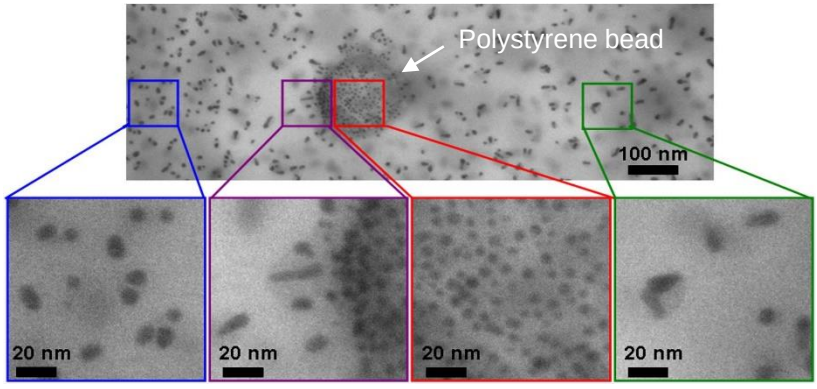
Silicate nanoparticles in water



Polystyrene bead in PBS (Phosphate-buffered saline)



SiO_2 nanoparticles in Cryo-TEM

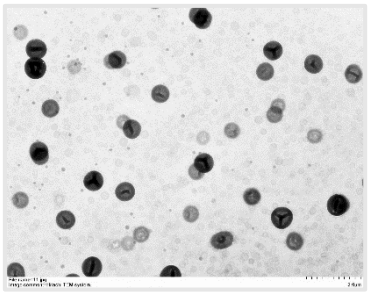


The growing Au nanoparticles nearby and far away from a polystyrene bead in $AuCl_4$ solution.

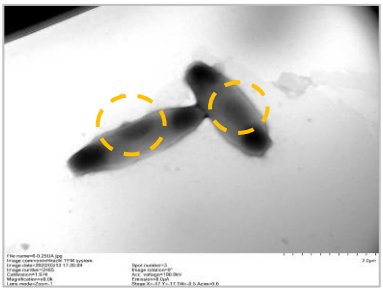
Enablement with K-Kit

1 Native state in liquid

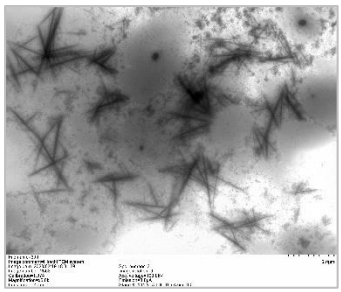
• Preserve the original morphology and physical state in liquid.



Extracellular vesicles of platelets



The nucleoid of E.coli

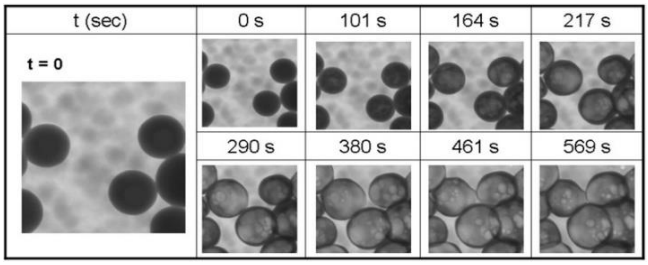


Collagen bundles in liquid

2 In-situ observation

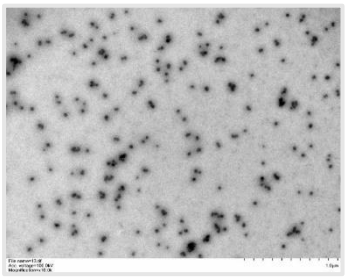
• Kinetic mechanism of metal growth or physicochemical reaction process in liquid can be in-situ observed with increased reaction time.

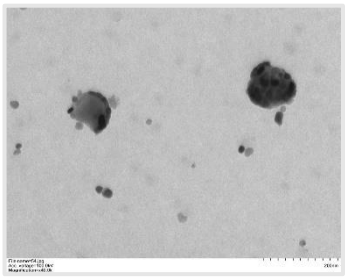
Dynamic observation of silicate nanoparticles



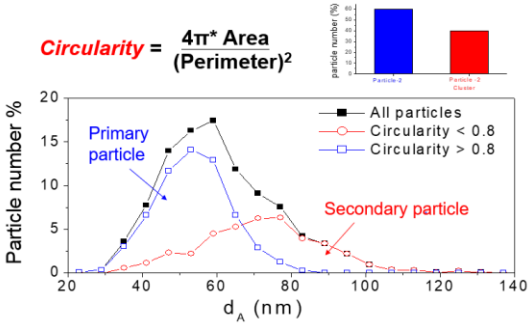
3 Quantitative analysis

• Software of image recognition for nanoparticle size distribution analysis.



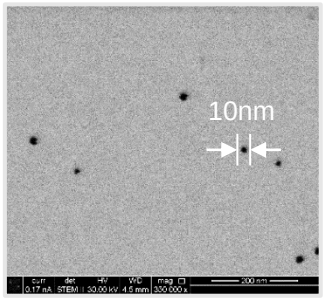


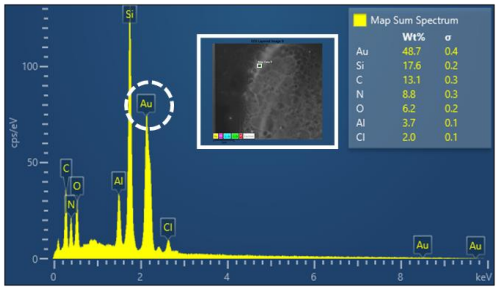
Nanoparticles of CMP slurry in K-kit



4 SEM & EDX analysis

• Nanoparticles in K-kit with sizes less than 10nm also could be nicely resolved in SEM.



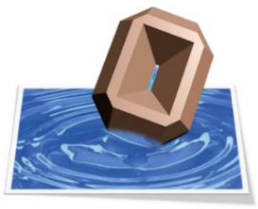


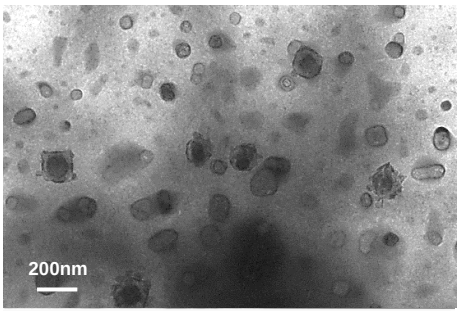
Au nanoparticles were imaged and analyzed by FEI Helios 400 SEM

Enablement with K-Kit

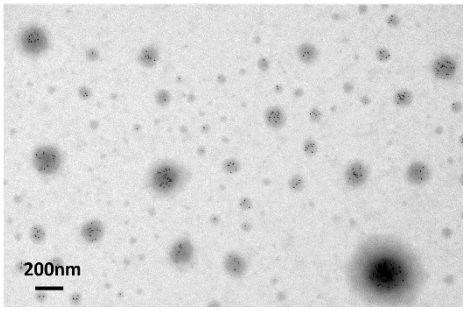
5 Negative staining and multiple loadings

(Appl. Sci. 2020, 10, 4946)





Negative staining TEM image of isolated platelet granules in K-kit

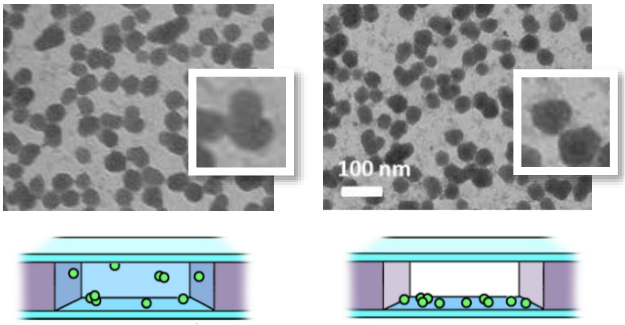


Immunoelectron TEM image of platelet granules in K-kit (By multiple loadings)

- Some bio-samples which with very low image contrast in TEM can be also clearly observed by using K-kit with a negative staining treatment.
- With an unibody structure, it allows K-kit to be used on the applications with multiple loadings, e.g., immunoelectron microscopy studies.

6 Wet and Dry modes

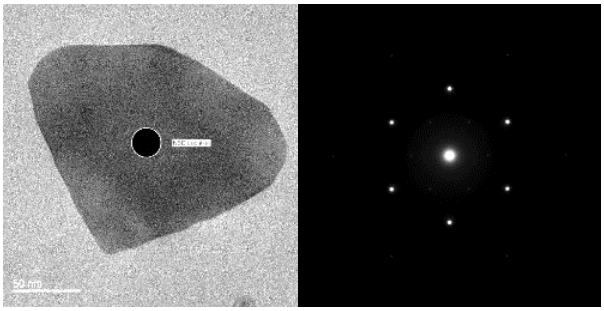
- **Wet mode:**
  - With liquid fully or partially filled in K-kit.
- **Dry mode:**
  - A patented liquid drying protocol, with a thin liquid or fully dry state in K-kit. It can preserve the original morphology of nanomaterials along with the imaging results improved at the same time.



Undiluted Chemical-Mechanical Polishing (CMP) slurry directly loaded into K-kit.

7 TEM diffraction pattern

- TEM diffraction patterns of nanoparticles in liquid can be analyzed by using K-kit. In this example, Au nanoparticles were formed from reduction process with $AuCl_4$ solution and analyzed with FEI Tecnai TEM @200KV.

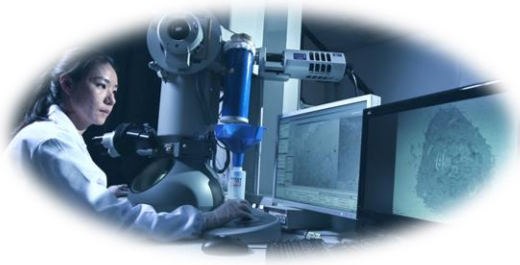


NBD (Nano-beam diffraction) result of a gold nanoparticle analyzed from a wet-mode K-kit.

Not only K-kit

Bio MA-tek provides comprehensive services in bio-EM and physicochemical analysis

Bio MA-tek provides total solution services, based on recommendations in ISO/TR13014 – 8 parameters



Size / Size distribution
Dynamic light scattering
Analysis of SEM, TEM or SPM images
Size exclusion chromatography

Shape
Analysis shape of SEM, TEM, or SPM images

Composition
X-ray diffraction (XRD)
X-ray photoelectron spectroscopy (XPS)
Raman and other molecular spectroscopies
Thermogravimetric analysis
Auger electron spectroscopy (AES)
Electron microscopy
Inductively Coupled Plasma Mass Spectrometer (ICP-MS)
Inductively Coupled Plasma Optical Emission Spectrometer (ICP-OES)

Surface area
Methods based on gas or liquid adsorption isotherms

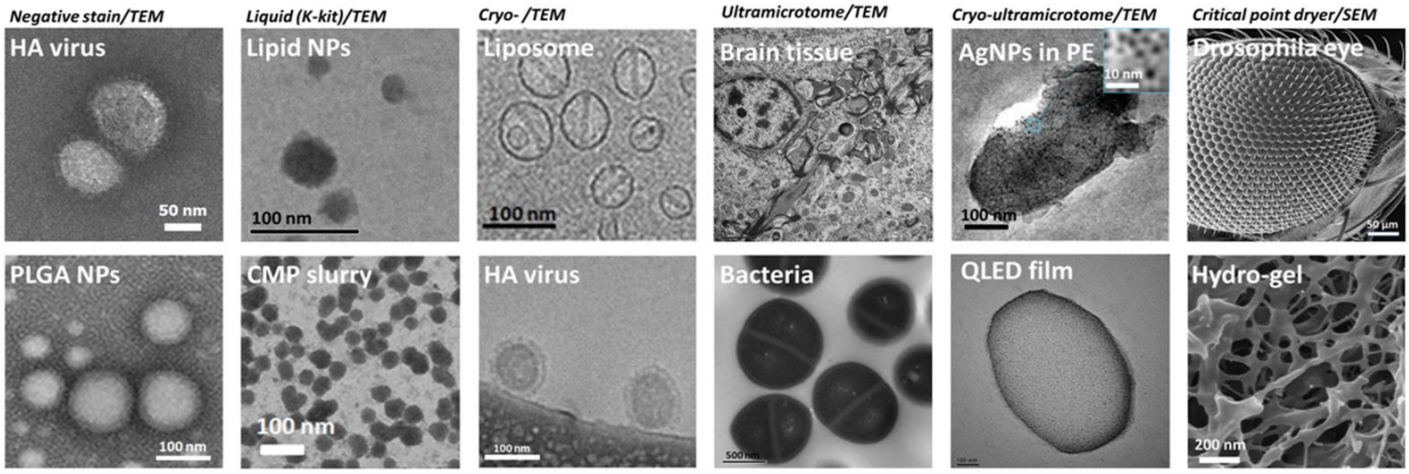
Solubility / dispersibility
Inductively Coupled Plasma Mass Spectrometer (ICP-MS)
* Liquid Sample TEM (K-kit)

Surface charge
Isoelectric point
Electrophoretic light scattering
Electrophoresis

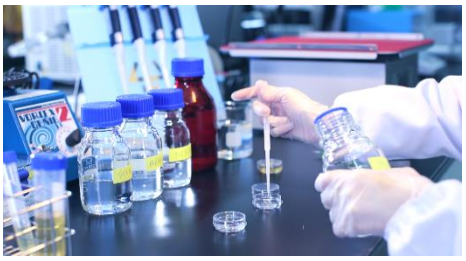
Aggregation / agglomeration state
Analysis of Cryo-SEM, or Cryo-TEM image
Centrifugal liquid sedimentation
* Liquid Sample TEM (K-kit)

Surface chemistry
X-ray diffraction (XRD)
X-ray photoelectron spectroscopy (XPS)
Auger electron spectroscopy (AES)
Scanning auger electron microscopy
Secondary ion mass spectroscopy (SIMS)
Energy dispersive x-ray spectrometry
Electron energy loss spectroscopy (EELS)
Roman and other molecular spectroscopies

Liquid sample TEM (K-kit)
Specimen Kit for observing the original morphology and physical state of nanomaterials in liquid sample by TEM. (US 7,807,979 B2 Oct. 5, 2010)



Our services



Bio MA-tek provides analytical services to the following industries:

- Bio-technology
- Pharmaceutical (nano-formulation, nano-drug, etc.)
- Vaccine (vaccine formulation, adjuvant, etc.)
- Medical devices (dialysis, dressing, etc.)
- Cosmetics (powder, cream, lotion, mask, etc.)
- Foods (additives, packaging materials, etc.)
- Academic & research organizations
- Electronics industry (Semiconductors, TFT-LCD, LED, PCBs, ...)
- Others

Service items

Physico-Chemical characterization

- Size/Size Distribution: DLS
- Surface Charge: Zeta potential
- Composition and Impurity: TGA, DSC, FT-IR, XRD, UPLC, ICP-MS, LC/ MS/ MS (QQQ)
- Surface Chemistry: XPS
- Surface Area: BET

Electron Microscopy analysis

- Negative stain
- Resin embedding
- Ultramicrotome
- Cryo-ultramicrotome
- Critical Point Drier (CPD)
- Cryo-transfer system
- Liquid sample preparation
- TEM/ EDX
- SEM/ EDX

About us

Bio MA-tek (Biotech Business Group of MA-tek Inc.) that established on March 31 of 2014 serves as the best R&D partner of high-tech industry, to address the ever demanding needs on the physical and chemical characterization of「nano materials」and「bio materials」in biological systems. Per the recommendations of ISO/TR13014, Bio MA-tek has introduced an array of bio-EM sample preparation and image analysis services as well as a comprehensive list of analytical services.

Vision

To become a leading brand in bio-medical materials analysis

Business model

Focus on core technology, leverage external resources, deliver proficient and adequate services

Positioning

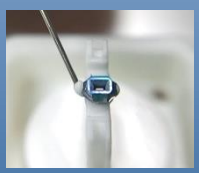
Solution provider of nano- biomaterials characterization and analysis

Service scope

Characterize and analyze nanobiomaterials in foods, cosmetics, medical materials, drugs, vaccines, biological tissue, etc. Provide proficient and adequate sample preparation, analysis, consultation, and contracted services.

Bio MA-tek, the best R&D partner for Your Success !



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