

■ PELCO® Gold Nanoarrays

Substrates of Quasi-ordered Arrays of Gold Nanoparticles

Nanoparticles serve as significant research tools in better understanding and unraveling the mysteries embodied in nanotechnology research. Colloidal gold particles, in particular, are both excellent catalysts for nanowire growth of a variety of materials and active sites for SERS (surface enhanced Raman scattering).

The line of PELCO® Gold Nanoarrays are unique products that provide:

- Substrate particle densities suited to SERS or material growth
- A choice of available substrates
- Excellent batch size uniformity and uniform particle distribution

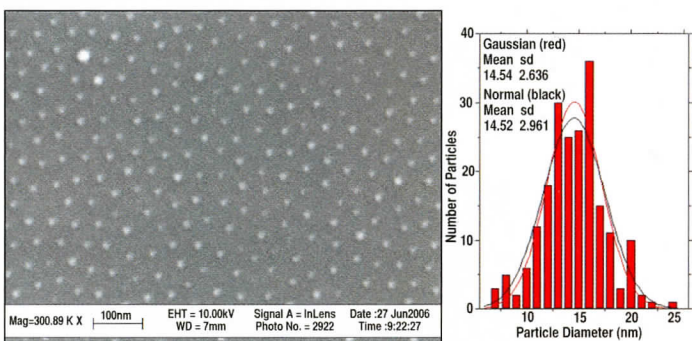


Figure 1: SEM image of a 15nm PELCO® Normal Density Gold Nanoarray. The histogram to the above shows the size distribution, mean and standard deviation for the array

Uniform and regular coverage of nanoparticles is highly desirable for systematic and reproducible results. Ordered arrays are ideal. PELCO® Gold Nanoarrays overcome the problems associated with other methods: 1) The high cost of electron beam lithography; 2) the random dispersion from absorptive or evaporative colloid deposition.

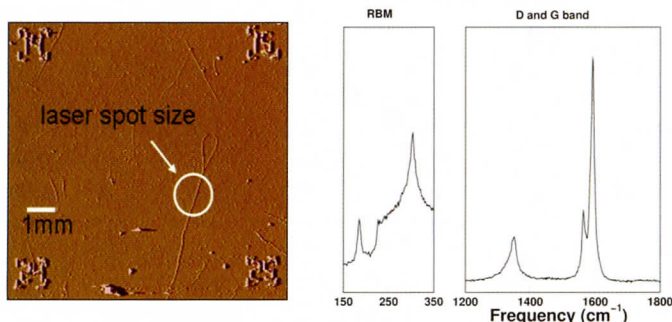


Figure 2: SERS - AFM image of an isolated carbon nanotube on a PELCO® Gold Nanoarray (30nm Au on glass). The Raman spectrum was measured at 1mW with a 25mW HeNe (633nm) laser. Courtesy of Steve Cronin, USC.

The PELCO® Gold Nanoarrays are available on a number of substrates:

- Glass: 5 x 10mm
- Quartz: 5 x 10mm
- Silicon: 5 x 10mm

The gold nanoarrays have the following characteristics:

- 15 or 30nm average particle diameter
- Excellent uniformity and particle distribution
- Normal density coating for material growth (Figure 1)
- High density coating for SERS (Figures 2 and 3)

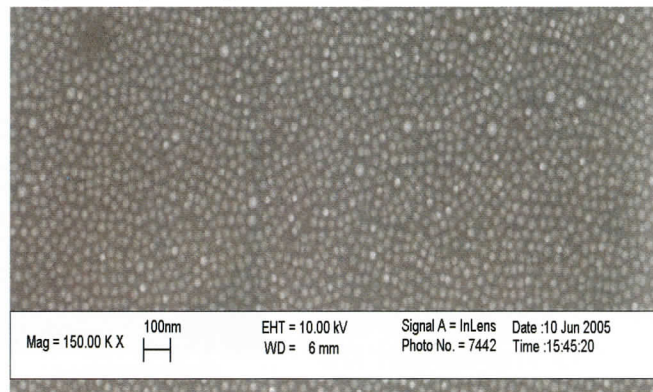


Figure 3: SEM image of a PELCO® array demonstrating high density coverage for the 30nm gold particles on a quartz substrate. The histogram, below right, is indicating the particle size distribution of the array.

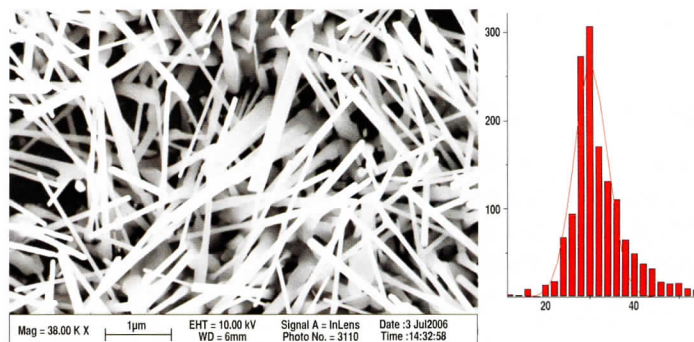


Figure 4: ZnO nanowires grown using a PELCO® Gold Nanoarray (gold nanoparticles on a quartz substrate) [1,2]

1. Geng, C. et al., 2004. Adv. Funct. Mater., 14:589-594.
2. Huang, et al, 2001. Adv. Mater., 13:113-116.

Normal Density: Particle distribution suited for material growth, e.g. silicon and ZnO nanowires.

High Density: particle distribution suited for SERS applications.

PELCO® 15nm Gold Nanoarrays

- 32100** PELCO® 15nm Gold Nanoarray, Normal Density on 5 x 10mm Glass Substrateeach
- 32101** PELCO® 15nm Gold Nanoarray, Normal Density on 5 x 10mm Quartz Substrateeach
- 32102** PELCO® 15nm Gold Nanoarray, Normal Density on 5 x 10mm Silicon Substrateeach
- 32110** PELCO® 15nm Gold Nanoarray, High Density on 5 x 10mm Glass Substrateeach
- 32111** PELCO® 15nm Gold Nanoarray, High Density on 5 x 10mm Quartz Substrateeach
- 32112** PELCO® 15nm Gold Nanoarray, High Density on 5 x 10mm Silicon Substrateeach

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■ PELCO® Gold Nanoarrays

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PELCO® 30nm Gold Nanoarrays

- 32200** PELCO® 30nm Gold Nanoarray, Normal Density on 5 x 10mm Glass Substrateeach
- 32201** PELCO® 30nm Gold Nanoarray, Normal Density on 5 x 10mm Quartz Substrateeach
- 32202** PELCO® 30nm Gold Nanoarray, Normal Density on 5 x 10mm Silicon Substrateeach
- 32210** PELCO® 30nm Gold Nanoarray, High Density on 5 x 10mm Glass Substrateeach
- 32211** PELCO® 30nm Gold Nanoarray, High Density on 5 x 10mm Quartz Substrateeach
- 32212** PELCO® 30nm Gold Nanoarray, High Density on 5 x 10mm Silicon Substrateeach

■ NanoColloids

Au and Ag Nanoparticles from BBI

These colloidal gold and silver particles are well known to a large group of users and have served in numerous research projects. They are manufactured to size and shape specifications for immunolabeling applications. The nanoparticles are cited in the literature for use in light scattering (Raman or plasmon resonance), nanotechnology research, as probes for a wide range of labeling applications, lateral flow (dipstick tests and nanostandards for atomic force microscopy).

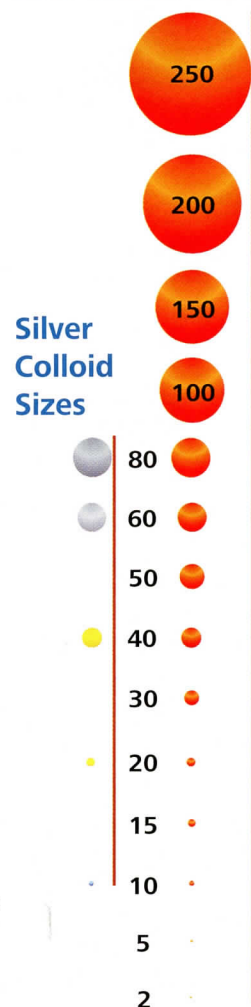
The BBI NanoColloids are characterized by:

- Coefficients of variation <8% for colloids >20nm
- Gold colloids from 2nm to 250nm in diameter
- Citrate stabilized/capped gold colloids
- Supplied in water
- Negative surface charge on gold/silver colloids

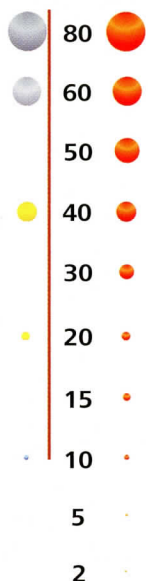
Protocols are available for the conjugation of gold particles to proteins and antibodies.

The following figure is representative of the quality control that allows the conjugates to be used in double-labeling experiments with any combination of gold colloid sizes.

Gold Colloid Sizes

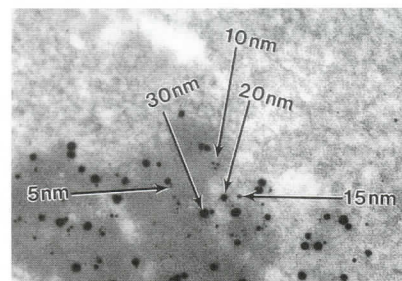


Silver Colloid Sizes



employing blotting, light or electron microscopy for data collection.

British Biocell International was one of the first manufacturers of gold nanoparticles for research and clinical applications and has become the leader in this field.



Gold and silver colloids or sols are available in a number of different sizes. There are 14 different gold colloids sizes and 4 different silver sizes. The products are best stored at room temperature, although storage at 4° C is an option. However, temperatures too close to freezing will destabilize the sol, causing aggregation and product loss. All gold colloids are supplied at an OD of 1 at 530nm except for the 2nm particle size which is approximately OD 0.2 at 460nm.

Gold Colloid Color/Size Variation



Gold Colloids (Sols)

Gold Particle Size	Particles/ml	20ml Product No.	100ml Product No.	500ml Product No.
2nm	1.5×10^{14}	15701-20	15701-1	15701-5
5nm	5.0×10^{13}	15702-20	15702-1	15702-5
10nm	5.7×10^{12}	15703-20	15703-1	15703-5
15nm	1.4×10^{12}	15704-20	15704-1	15704-5
20nm	7.0×10^{11}	15705-20	15705-1	15705-5
30nm	2.0×10^{11}	15706-20	15706-1	15706-5
40nm	9.0×10^{10}	15707-20	15707-1	15707-5
50nm	4.5×10^{10}	15708-20	15708-5	15708-55
60nm	2.6×10^{10}	15709-20	15708-6	15708-65
80nm	1.1×10^{10}	15710-20	15708-8	15708-85
100nm	5.6×10^9	15711-20	15708-9	15708-95
150nm	1.7×10^9	15712-20	15709-10	15709-105
200nm	7.0×10^8	15713-20	15709-11	15709-115
250nm	3.6×10^8	15714-20	15709-12	15709-125

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■ NanoColloids

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Silver Colloid Color/Size Variation



20nm

40nm

60nm

80nm

Silver Colloids (Sols)

Silver Particle Size	Particles/ml	100ml Product No.	500ml Product No.
20nm	7.0×10^{11}	15705-1SC	15705-5SC
40nm	9.0×10^{10}	15707-1SC	15707-5SC
60nm	3.1×10^{10}	15708-6SC	15708-65SC
80nm	1.1×10^{10}	15708-8SC	15708-85SC

Silver Enhancement Kits for Metal Particle Growth

These are light insensitive kits for metal nanoparticle growth. Particle size can be increased from 2 to 100x based on the time and temperature of the reaction. Equal volumes of developer and enhancer are mixed and then deposited on the nanoparticle surface. Metal enhancement times should not exceed 2 minutes for best results. Fresh mixtures can be applied if larger particle sizes are desired. Rinse with DI or other water to stop the reaction.

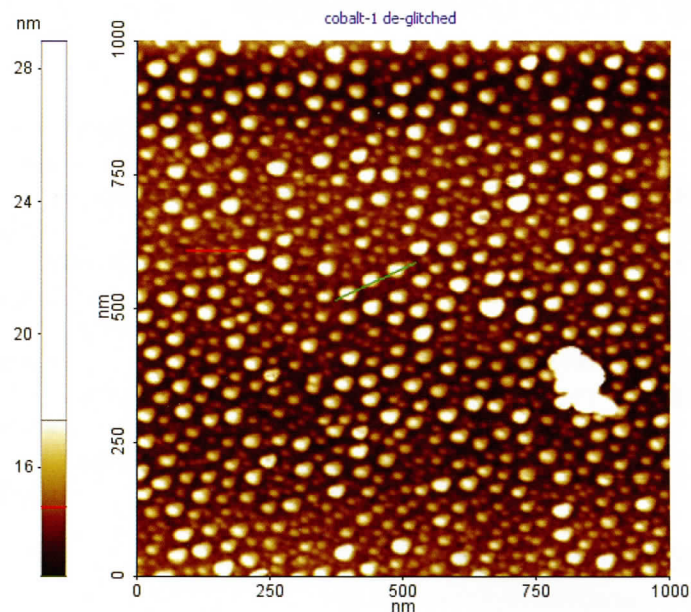
Silver Enhancement Kits

Product No.	Kit Components	Storage Conditions
15718	Silver Enhancement Kit for small surface area (mm ²) enhancement - 30ml	Store at 4° C or -25°C
15719	Silver Enhancement Kit for large surface area (cm ²) enhancement - 500ml	Store at 4° C or -25°C

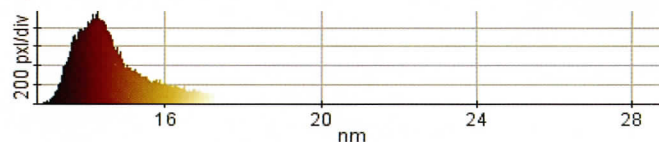
■ PELCO® AFM Tip and Resolution Test Specimen

Colloidal cobalt provides an excellent substrate for AFM tip characterization and instrument operation. Image at top demonstrates height calibration at 1nm (red line profile) and 3nm (green line profile) on the standard.

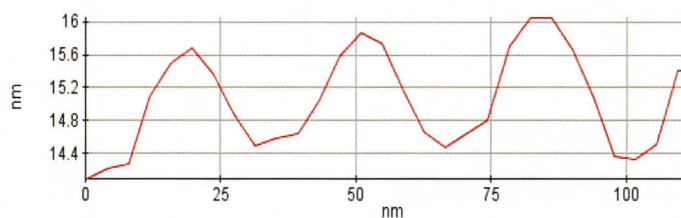
Available on 5x5mm silicon wafer chips unmounted or mounted on 12mm stainless steel metal disk. Tip characterization down to angstrom resolution is easily attained. Image at top demonstrates 1 and 3nm height resolution accurate to 0.05nm.



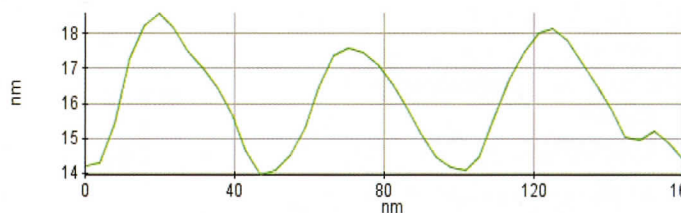
Histogram



Line Profile: Red



Line Profile: Green



Statistics

Line	Min(nm)	Max(nm)	Mid(nm)	Mean(nm)	Rpv(nm)	Rq(nm)	Ra(nm)	Rz(nm)	Rsk	Rku
Red	14.092	16.050	15.071	15.025	1.958	0.590	0.519	N/A	-0.176	1.719
Green	13.955	18.566	16.260	16.012	4.610	1.412	1.271	N/A	-0.116	1.634

- 628 PELCO® AFM Tip and Resolution Test Specimen, Unmountedeach
- 628-AFM PELCO® AFM Tip and Resolution Test Specimen, Mount AFMeach