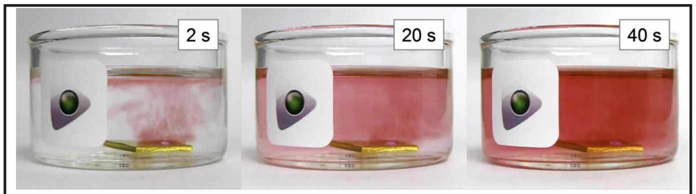
Reactant & Surfactant-free pure Nanoparticles via Laser Ablation

Particular
customized material

METALS • INORGANICS • ORGANOMETALLICS • CATALYSTS • LIGANDS • NANOMATERIALS • CUSTOM SYNTHESIS • cGMP FACILITIES

What is Laser Ablation?

Laser ablation is a physical process used to generate nanoparticles. It involves the use of short pulses of laser energy focused on a target in a solvent. The target absorbs the energy from the laser pulse and is vaporized. The vaporized material then condenses as **nanoparticles**.

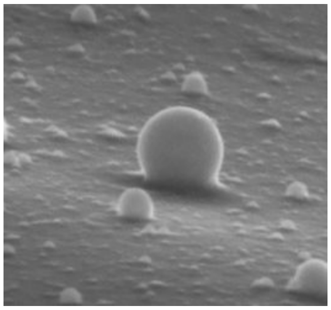


Basic process of pure, physical laser ablation in liquids, demonstrated at a gold foil in an open glass vessel. (For production, Particular uses ablation chambers instead)

Why Laser Ablation?

Laser ablation generates **nanoparticle** dispersions that are free of any contaminants, such as unreacted starting materials.

The use of **short laser pulses** makes it possible to carry out the **ablation process** in a wide range of carriers, including volatile organic solvents and reactive monomers. The laser technology also allows the conversion of almost any solid or powder material into a colloid. And that means that nearly endless material combinations are possible by varying the target and the solvent for screening studies and individual applications.

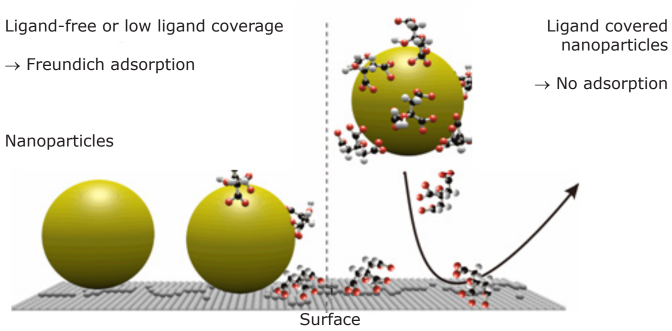


Nanoparticle from titanium

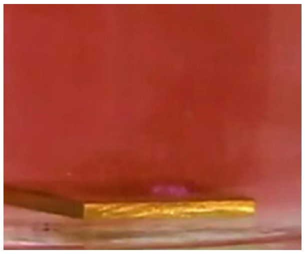
In addition, the released **nanoparticles** have a positive charge on the surface, and thus electrostatic stabilization by the surrounding medium occurs without the need, in most cases, for any type of chemical stabilizer.

The positive surface charge also provides a means for interaction with molecules that bear electron-donating substituents. In-situ functionalization is also possible with monomers, polymers and biomolecules. Deposition can also be achieved using electrophoresis.

In fact, **laser-generated nanoparticles** can be readily and permanently immobilized on micro- and nanoparticulate supports under ambient conditions without heat treatment. And because the **nanoparticles** are not covered with hydrophobic ligands, even water-insoluble supports like oxides, sulfates and phosphates can be used. Their high purity also means that supported catalysts prepared from laser-generated nanoparticles don't suffer from poisoning.



Courtesy of University of Duisburg-Essen



Laser ablation at a gold foil

Advantages of Laser Ablation Generated Nanoparticles

- Very high purity – free of particle-associated residual chemicals
- High stability due to electrostatic stabilization (12 mo., 2mo. in H_20)
- High dispersibility
- Direct use of organic solvents
- Adjustable ion release rates
- Increase adsorption efficiency and reduced cost
- High bio-compatibility in different applications
- Higher reactivity and lower toxicity for medical/pharma applications

Possible Applications for Ablation Generated Nanoparticles

- Biomedical, immunoassay, and toxicology studies
- Targeted drug delivery
- Supported heterogeneous catalysts
- Nanocoatings
- Nanocomposites

Visit **www.strem.com** for new product information and a searchable catalog.

Strem Chemicals, Inc.
7 Mulliken Way
Newburyport, MA 01950
U.S.A
Tel: 978.499.1600
Fax: 978.465.3104
Email: info@strem.com

Strem Chemicals, Inc.
15, rue de l'Atome
Zone Industrielle
67800 BISCHHEIM France
Tel: (33) 03 88 62 52 60
Fax: (33) 03 88 62 26 81
Email: info.europe@strem.com

Strem Chemicals, Inc.
Postfach 1215
77672 KEHL
Germany
Tel: 0 78 51/ 7 58 79

Email: info.europe@strem.com

Strem Chemicals UK Ltd.
An Independent Distributor of Strem Chemicals Products
Newton Hall, Town Street
Newton, Cambridge
England CB22 7ZE
Tel: 0845 643 7263
Fax:0845 643 7362
Email: enquiries@strem.co.uk

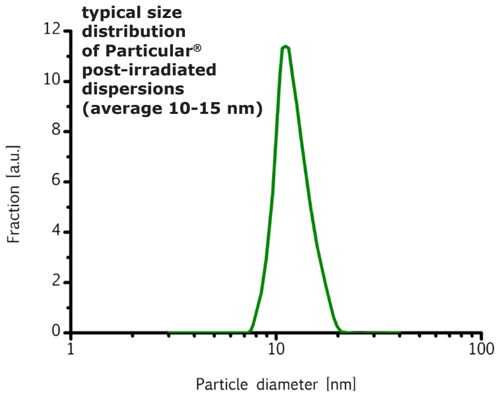
Selection Matrix for Nanoparticles prepared using Laser Ablation

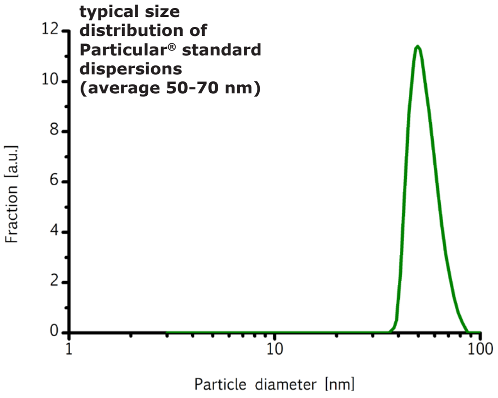
Strem offers a wide range of residue-free nanoparticles prepared via Laser Ablation by Particular GmbH.

Selection Matrix: pick element, size, concentration and solvent from available list

Element	Size	Concentration		Solvent			
		100mg/L	500mg/L	water	acetone	ethylene glycol	iso propanol
Ag	<20nm	x	x	x	100mg/L only		
	50-70nm	x			x		
Au	<20nm	x	x	x	100mg/L only		100mg/L only
	50-70nm	x					x
Pt	<20nm	x	x	x	100mg/L only		100mg/L only
	50-70nm	x			x		x
Pd	<20nm	x	x	x	100mg/L only		
	50-70nm	x			x		
Rh	<20nm	x	x	x	100mg/L only		100mg/L only
Ru	50-70nm	x			x		
Cu	<20nm	x			x		
Ti	<20nm	x			x		
	50-70nm	x				x	x

x = available
Stability: 12 months (2 months in water)





Nanoparticles from metals (silver, titanium, platinum, gold) in water

Catalog #	Description
79-0410	Gold nanoparticles, pure, (<20nm) in water at 100mg/L (surfactant and reactant-free, OD>1, stabilized with < 0.01 mmol/l of citrate)
79-0412	Gold nanoparticles, pure, (<20nm) in acetone at 100mg/L (surfactant and reactant-free)
79-0416	Gold nanoparticles, pure, (<20nm) in isopropanol at 100mg/L (surfactant and reactant-free)
79-0418	Gold nanoparticles, pure, (<20nm) in water at 500mg/L (surfactant and reactant-free, OD>5, stabilized with < 0.01 mmol/l of citrate)
79-0426	Gold nanoparticles, pure, (50-70nm) in isopropanol at 100mg/L (surfactant and reactant-free)
47-0710	Silver nanoparticles, pure, (<20nm) in water at 100mg/L (surfactant and reactant-free, stabilized with < 0.01 mmol/l of citrate)
47-0712	Silver nanoparticles, pure, (<20nm) in acetone at 100mg/L (surfactant and reactant-free)
47-0718	Silver nanoparticles, pure, (<20nm) in water at 500mg/L (surfactant and reactant-free, stabilized with < 0.01 mmol/l of citrate)
47-0222	Silver nanoparticles, pure, (50-70nm) in acetone at 100mg/L (surfactant and reactant-free)
78-1402	Platinum nanoparticles, pure, (<20nm) in water at 100mg/L (surfactant and reactant-free, stabilized with < 0.01 mmol/l of citrate)
78-1404	Platinum nanoparticles, pure, (<20nm) in acetone at 100mg/L (surfactant and reactant-free)
78-1408	Platinum nanoparticles, pure, (<20nm) in isopropanol at 100mg/L (surfactant and reactant-free)
78-1410	Platinum nanoparticles, pure, (<20nm) in water at 500mg/L (surfactant and reactant-free, stabilized with < 0.01 mmol/l of citrate)
78-1414	Platinum nanoparticles, pure, (50-70nm) in acetone at 100mg/L (surfactant and reactant-free)
78-1418	Platinum nanoparticles, pure, (50-70nm) in isopropanol at 100mg/L (surfactant and reactant-free)
46-4010	Palladium nanoparticles, pure, (<20nm) in water at 100mg/L (surfactant and reactant-free, stabilized with < 0.01 mmol/l of citrate)
46-4012	Palladium nanoparticles, pure, (<20nm) in acetone at 100mg/L (surfactant and reactant-free)
46-4022	Palladium nanoparticles, pure, (50-70nm) in acetone at 100mg/L (surfactant and reactant-free)
45-1322	Rhodium nanoparticles, pure, (<20nm) in water at 100mg/L (surfactant and reactant-free, stabilized with < 0.01 mmol/l of citrate)
45-1324	Rhodium nanoparticles, pure, (<20nm) in acetone at 100mg/L (surfactant and reactant-free)
45-1328	Rhodium nanoparticles, pure, (<20nm) in isopropanol at 100mg/L (surfactant and reactant-free)
45-1330	Rhodium nanoparticles, pure, (<20nm) in water at 500mg/L (surfactant and reactant-free, stabilized with < 0.01 mmol/l of citrate)
44-2812	Ruthenium nanoparticles, pure, (<20nm) in acetone at 100mg/L (surfactant and reactant-free)
44-2822	Ruthenium nanoparticles, pure, (50-70nm) in acetone at 100mg/L (surfactant and reactant-free)
29-0092	Copper nanoparticles, pure, (<20nm) in acetone at 100mg/L (surfactant and reactant-free)
22-0192	Titanium nanoparticles, pure, (<20nm) in acetone at 100mg/L (surfactant and reactant-free)
22-0198	Titanium nanoparticles, pure, (50-70nm) in ethylene glycol at 100mg/L (surfactant and reactant-free)
22-0203	Titanium nanoparticles, pure, (50-70nm) in isopropanol at 100 mg/L (surfactant and reactant-free)

Note: Particle size of 50-70 nm is measured via DLS, colloid may also contain significant fractions of smaller particles.

References:

1. Wagener, P.; Barcikowski, S.; Bärsch, N.: Fabrication of nanoparticles and nanomaterials using laser ablation in liquids. In: Photonik international I/2011.
2. Wagener, P.; Schwenke, A.; Barcikowski, S.: How Citrate Ligands Affect Nanoparticle Adsorption to Microparticle Supports. In: Langmuir 28 (2012), pp. 6132-6140.
3. Sajti, C. L.; Sattari, R.; Chichkov, B. N.; Barcikowski, S.: Gram Scale Synthesis of Pure Ceramic Nanoparticles by Laser Ablation in Liquid. In: Journal of Physical Chemistry C 114 (2010), 6, pp. 2421–2427.
4. Petersen, S.; Barcikowski, S.: Conjugation Efficiency of Laser-Based Bioconjugation of Gold Nanoparticles with Nucleic Acids. In: The Journal of Physical Chemistry C 113 (2009), 46, pp. 19830-19835.