

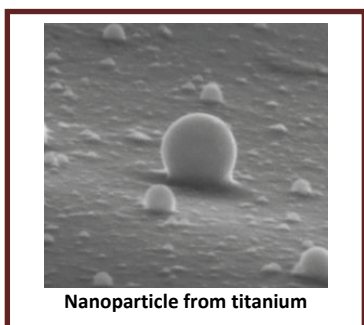
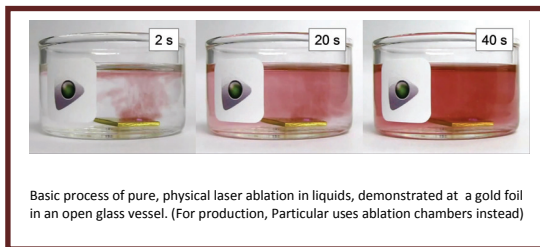
## What is Laser Ablation?

**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**.

## 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.



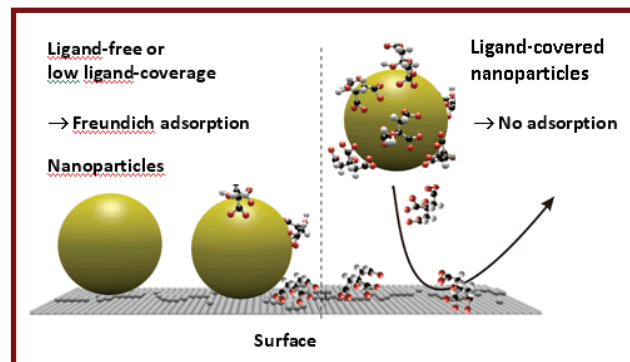
In addition, the released **nanoparticles** have a positive charge on the surface, and thus electrostatic stabilization by the surrounding medium occurs without the need, in most cases, for any type of chemical stabilizer.

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.

### 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<sub>2</sub>O)
- ❖ 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



Courtesy University of Duisburg-Essen.



### Possible Applications for Ablation Generated Nanoparticles

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

Visit [www.strem.com](http://www.strem.com) for new product information and searchable catalog.

#### Strem Chemicals, Inc.

7 Mulliken Way  
Newburyport, MA 01950-4098  
U.S.A.  
Tel.: (978) 499-1600  
Fax: (978) 465-3104  
Email: [info@strem.com](mailto:info@strem.com)  
[particular\\_nano0213.doc](#)

#### 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](mailto:info.europe@strem.com)

#### Strem Chemicals, Inc.

Postfach 1215  
77672 KEHL  
Germany  
Telefon: 0 78 51/ 7 58 79  
Email: [info.europe@strem.com](mailto:info.europe@strem.com)

#### Strem Chemicals UK Ltd.

41 Hills Road  
Cambridge  
England CB2 1NT  
Tel.: 0845 643 7263  
Fax: 0845 643 7362  
Email: [enquiries@strem.co.uk](mailto:enquiries@strem.co.uk)

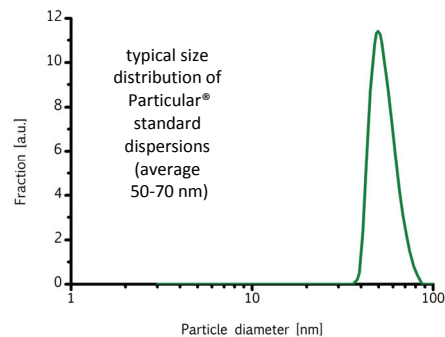
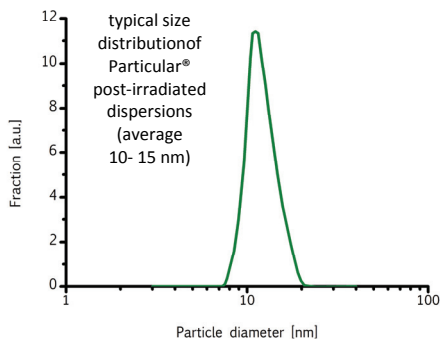
## Selection Matrix for Nanoparticles prepared using Laser Ablation

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

Selection Matrix- pick element, size, concentration, solvent from available list

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

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



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

Visit [www.strem.com](http://www.strem.com) for new product information and searchable catalog.

**Strem Chemicals, Inc.**  
 7 Mulliken Way  
 Newburyport, MA 01950-4098  
 U.S.A.  
 Tel.: (978) 499-1600  
 Fax: (978) 465-3104  
 Email: [info@strem.com](mailto:info@strem.com)  
 particular\_nano0213.doc

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

**Strem Chemicals, Inc.**  
 Postfach 1215  
 77672 KEHL  
 Germany  
 Telefon: 0 78 51/ 7 58 79  
 Email: [info.europe@strem.com](mailto:info.europe@strem.com)

**Strem Chemicals UK Ltd.**  
 41 Hills Road  
 Cambridge  
 England CB2 1NT  
 Tel.: 0845 643 7263  
 Fax: 0845 643 7362  
 Email: [enquiries@strem.co.uk](mailto:enquiries@strem.co.uk)



## Reactant & Surfactant-free pure Nanoparticles via Laser Ablation



**Particular**  
customized material

### Cat. No.    Description

<b>79-0410</b>	Gold nanoparticles, pure, (<20nm) in water at 100mg/L (surfactant and reactant-free, OD>1, stabilized with < 0.01 mmol/l of citrate)
<b>79-0412</b>	Gold nanoparticles, pure, (<20nm) in acetone at 100mg/L (surfactant and reactant-free)
<b>79-0414</b>	Gold nanoparticles, pure, (<20nm) in ethylene glycol at 100mg/L (surfactant and reactant-free)
<b>79-0416</b>	Gold nanoparticles, pure, (<20nm) in isopropanol at 100mg/L (surfactant and reactant-free)
<b>79-0418</b>	Gold nanoparticles, pure, (<20nm) in water at 500mg/L (surfactant and reactant-free, OD>5, stabilized with < 0.01 mmol/l of citrate)
<b>79-0420</b>	Gold nanoparticles, pure, (50-70nm) in water at 100mg/L (surfactant and reactant-free, OD>1, stabilized with < 0.01 mmol/l of citrate)
<b>79-0422</b>	Gold nanoparticles, pure, (50-70nm) in acetone at 100mg/L (surfactant and reactant-free)
<b>79-0424</b>	Gold nanoparticles, pure, (50-70nm) in ethylene glycol at 100mg/L (surfactant and reactant-free)
<b>79-0426</b>	Gold nanoparticles, pure, (50-70nm) in isopropanol at 100mg/L (surfactant and reactant-free)
<b>79-0428</b>	Gold nanoparticles, pure, (50-70nm) in water at 500mg/L (surfactant and reactant-free, OD>5, stabilized with < 0.01 mmol/l of citrate)
<b>47-0710</b>	Silver nanoparticles, pure, (<20nm) in water at 100mg/L (surfactant and reactant-free, stabilized with < 0.01 mmol/l of citrate)
<b>47-0712</b>	Silver nanoparticles, pure, (<20nm) in acetone at 100mg/L (surfactant and reactant-free)
<b>47-0718</b>	Silver nanoparticles, pure, (<20nm) in water at 500mg/L (surfactant and reactant-free, stabilized with < 0.01 mmol/l of citrate)
<b>47-0720</b>	Silver nanoparticles, pure, (50-70nm) in water at 100mg/L (surfactant and reactant-free, stabilized with < 0.01 mmol/l of citrate)
<b>47-0722</b>	Silver nanoparticles, pure, (50-70nm) in acetone at 100mg/L (surfactant and reactant-free)
<b>47-0726</b>	Silver nanoparticles, pure, (50-70nm) in isopropanol at 100mg/L (surfactant and reactant-free)
<b>47-0728</b>	Silver nanoparticles, pure, (50-70nm) in water at 500mg/L (surfactant and reactant-free, stabilized with < 0.01 mmol/l of citrate)
<b>78-1402</b>	Platinum nanoparticles, pure, (<20nm) in water at 100mg/L (surfactant and reactant-free, stabilized with < 0.01 mmol/l of citrate)
<b>78-1404</b>	Platinum nanoparticles, pure, (<20nm) in acetone at 100mg/L (surfactant and reactant-free)
<b>78-1408</b>	Platinum nanoparticles, pure, (<20nm) in isopropanol at 100mg/L (surfactant and reactant-free)
<b>78-1410</b>	Platinum nanoparticles, pure, (<20nm) in water at 500mg/L (surfactant and reactant-free, stabilized with < 0.01 mmol/l of citrate)
<b>78-1412</b>	Platinum nanoparticles, pure, (50-70nm) in water at 100mg/L (surfactant and reactant-free, stabilized with < 0.01 mmol/l of citrate)
<b>78-1414</b>	Platinum nanoparticles, pure, (50-70nm) in acetone at 100mg/L (surfactant and reactant-free)
<b>78-1416</b>	Platinum nanoparticles, pure, (50-70nm) in ethylene glycol at 100mg/L (surfactant and reactant-free)
<b>78-1418</b>	Platinum nanoparticles, pure, (50-70nm) in isopropanol at 100mg/L (surfactant and reactant-free)
<b>78-1422</b>	Platinum nanoparticles, pure, (50-70nm) in water at 500mg/L (surfactant and reactant-free, stabilized with < 0.01 mmol/l of citrate)

Visit [www.strem.com](http://www.strem.com) for new product information and searchable catalog.

#### **Strem Chemicals, Inc.**

7 Mulliken Way  
Newburyport, MA 01950-4098  
U.S.A.  
Tel.: (978) 499-1600  
Fax: (978) 465-3104  
Email: [info@strem.com](mailto:info@strem.com)  
[particular\\_nano0213.doc](#)

#### **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](mailto:info.europe@strem.com)

#### **Strem Chemicals, Inc.**

Postfach 1215  
77672 KEHL  
Germany  
Telefon: 0 78 51/ 7 58 79  
Email: [info.europe@strem.com](mailto:info.europe@strem.com)

#### **Strem Chemicals UK Ltd.**

41 Hills Road  
Cambridge  
England CB2 1NT  
Tel.: 0845 643 7263  
Fax: 0845 643 7362  
Email: [enquiries@strem.co.uk](mailto:enquiries@strem.co.uk)

## Strem Nanoparticles prepared via Laser Ablation

Cat. No.	Description
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)
46-4018	Palladium nanoparticles, pure, (<20nm) in water at 500mg/L (surfactant and reactant-free, stabilized with < 0.01 mmol/l of citrate)
46-4020	Palladium nanoparticles, pure, (50-70nm) in water at 100mg/L (surfactant and reactant-free, stabilized with < 0.01 mmol/l of citrate)
46-4022	Palladium nanoparticles, pure, (50-70nm) in acetone at 100mg/L (surfactant and reactant-free)
46-4024	Palladium nanoparticles, pure, (50-70nm) in ethylene glycol at 100mg/L (surfactant and reactant-free)
46-4028	Palladium nanoparticles, pure, (50-70nm) in water at 500mg/L (surfactant and reactant-free, stabilized with < 0.01 mmol/l of citrate)
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)
45-1332	Rhodium nanoparticles, pure, (50-70nm) in water at 100mg/L (surfactant and reactant-free, stabilized with < 0.01 mmol/l of citrate)
45-1334	Rhodium nanoparticles, pure, (50-70nm) in acetone at 100mg/L (surfactant and reactant-free)
45-1336	Rhodium nanoparticles, pure, (50-70nm) in ethylene glycol at 100mg/L (surfactant and reactant-free)
45-1338	Rhodium nanoparticles, pure, (50-70nm) in isopropanol at 100mg/L (surfactant and reactant-free)
45-1340	Rhodium nanoparticles, pure, (50-70nm) in water at 500mg/L (surfactant and reactant-free, stabilized with < 0.01 mmol/l of citrate)
44-2810	Ruthenium nanoparticles, pure, (<20nm) in water at 100mg/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)
44-2816	Ruthenium nanoparticles, pure, (<20nm) in isopropanol at 100mg/L (surfactant and reactant-free)
44-2818	Ruthenium nanoparticles, pure, (<20nm) in water at 500mg/L (surfactant and reactant-free, stabilized with < 0.01 mmol/l of citrate)
44-2820	Ruthenium nanoparticles, pure, (50-70nm) in water at 100mg/L (surfactant and reactant-free, stabilized with < 0.01 mmol/l of citrate)
44-2822	Ruthenium nanoparticles, pure, (50-70nm) in acetone at 100mg/L (surfactant and reactant-free)
44-2824	Ruthenium nanoparticles, pure, (50-70nm) in ethylene glycol at 100mg/L (surfactant and reactant-free)
44-2826	Ruthenium nanoparticles, pure, (50-70nm) in isopropanol at 100mg/L (surfactant and reactant-free)
44-2828	Ruthenium nanoparticles, pure, (50-70nm) in water at 500mg/L (surfactant and reactant-free, stabilized with < 0.01 mmol/l of citrate)
29-0092	Copper nanoparticles, pure, (<20nm) in acetone at 100mg/L (surfactant and reactant-free)
29-0096	Copper nanoparticles, pure, (50-70nm) in acetone at 100mg/L (surfactant and reactant-free)
29-0098	Copper nanoparticles, pure, (50-70nm) in ethylene glycol at 100mg/L (surfactant and reactant-free)
22-0192	Titanium nanoparticles, pure, (<20nm) in acetone at 100mg/L (surfactant and reactant-free)
22-0194	Titanium nanoparticles, pure, (<20nm) in ethylene glycol at 100mg/L (surfactant and reactant-free)
22-0196	Titanium nanoparticles, pure, (50-70nm) 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)

### References:

1. Wagener, P.; Barcikowski, S.; Bärsch, N.: Fabrication of nanoparticles and nanomaterials using laser ablation in liquids. In: [Photonik international 1/2011](#).
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](#).

Visit [www.strem.com](http://www.strem.com) for new product information and searchable catalog.

#### Strem Chemicals, Inc.

7 Mulliken Way  
Newburyport, MA 01950-4098  
U.S.A.  
Tel.: (978) 499-1600  
Fax: (978) 465-3104  
Email: [info@strem.com](mailto:info@strem.com)  
[particular\\_nano0213.doc](#)

#### 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](mailto:info.europe@strem.com)

#### Strem Chemicals, Inc.

Postfach 1215  
77672 KEHL  
Germany  
Telefon: 0 78 51/ 7 58 79  
Email: [info.europe@strem.com](mailto:info.europe@strem.com)

#### Strem Chemicals UK Ltd.

41 Hills Road  
Cambridge  
England CB2 1NT  
Tel.: 0845 643 7263  
Fax: 0845 643 7362  
Email: [enquiries@strem.co.uk](mailto:enquiries@strem.co.uk)