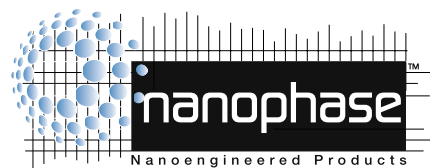


Nanoparticles and Dispersions

Exploring the Possibilities



Featuring products from
Nanophase Technologies





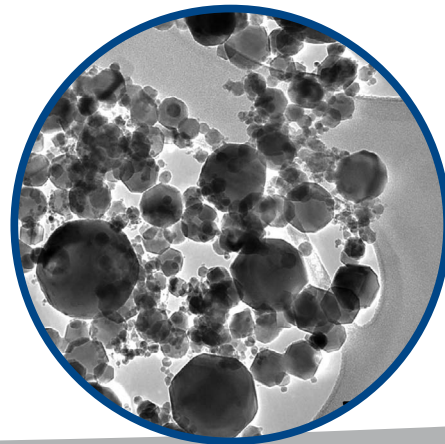
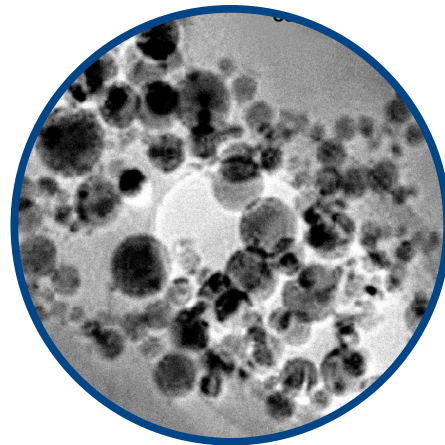
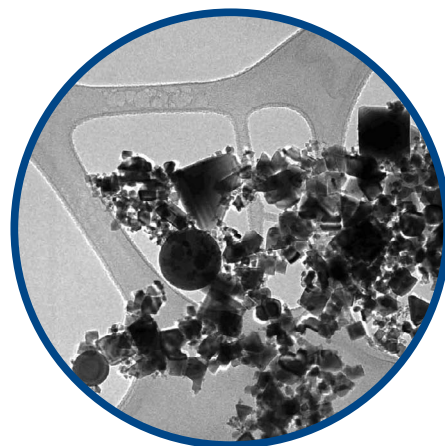
Nanoparticles and Dispersions

Exploring the Possibilities

Alfa Aesar, a leading supplier of research chemicals, metals and materials, and Nanophase Technologies, an industry-leading nanocrystalline materials innovator and manufacturer, have entered into a mutually exclusive partnership for the distribution of nanoparticles and nanoparticle dispersions.

Alfa Aesar is the sole distributor of research and development quantities for a group of Nanophase materials. These select products are listed in this brochure. The materials are in stock and available for immediate shipment. If there are materials of interest that are not listed in this brochure, please feel free to contact Alfa Aesar for further discussion.

Nanocrystalline powders from Nanophase typically have a mean particle size less than 100 nm, are non-porous single crystals, have defined surface chemistry, and are chemically pure. Alfa Aesar offers nanoparticles in powder form and as stable, ready to use dispersions from Nanophase Technologies.

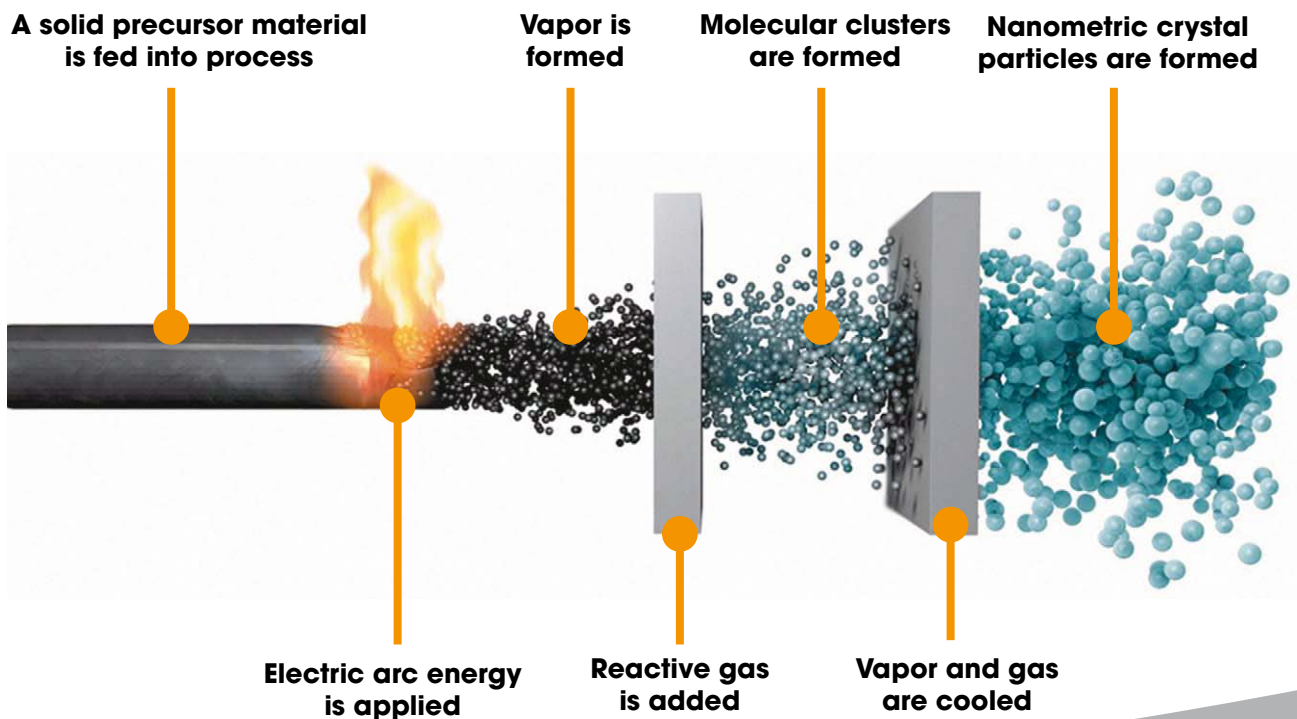


Synthesis Techniques

Nanoparticles are produced using one of two methods, Physical Vapor Synthesis (PVS) or NanoArc[®] Synthesis (NAS).

In the PVS process, arc energy is first applied to a solid metal precursor in order to generate a vapor at a high temperature. A reactant gas is added to the vapor, which is then cooled at a controlled rate and condenses to form nanoparticles.

Like the PVS process, the NAS process uses arc energy to produce nanoparticles. The NAS process, however, is capable of using a wide variety of precursor formats and chemical compositions, thereby greatly expanding the number of materials that can be manufactured as nanopowders at commercial scale.



Nanoparticles

The nanomaterials produced by both the NAS and PVS processes consist of discreet, fully-dense, fully crystalline particles. The PVS process yields particles with the average sizes ranging from 35-75 nm and those from the NAS process from 20-60 nm.

Nanoparticles can be surface treated to enable compatibility of the particles with a wide variety of fluids, resins and polymers. This patented technology ensures the appropriate surface treatment is applied to each individual particle, where the chemistry of the coating is selected to provide the characteristics required for compatibility. In this way, the nanoparticles retain their original chemistry and physical properties, but the coating can be tailored for a wide variety of applications and environments, including polar and non-polar organic systems.

Nanophase Particle Attributes

Particles less than 100 nanometers

Particles are equi-axed

High surface and chemical purity

Non-porous and fully crystalline
Non-friable
Near theoretical density

No durable secondary agglomerate structures

Nanoparticle Dispersions

In many cases, the successful application of nanoparticles in a particular application depends on the ability to properly disperse the nanoparticles into a fluid. Application areas as diverse as cosmetics, coatings, polishing and catalysis all require that the particles are initially well dispersed and that the particles stay well-dispersed (i.e. do not aggregate or “crash out” in the application environment) in order to exhibit their full activity. To meet this need, Nanophase has developed technology to permit the dispersion of its nanoparticles in water and a variety of polar and non-polar organic fluids. This technology provides a supply of concentrated, ready-to-use nanoparticle dispersions, eliminating the need for customers to disperse the nanoparticles themselves. This capability proves particularly attractive to customers who can benefit from Nanophase’s expertise in dispersing nanoparticles or wish to avoid handling dry powders.

Semi-bulk and Bulk Quantities

Items are available from stock in the standard pack sizes listed. Stocks are also available for semi-bulk and bulk quantities. Please call for a quotation on a bulk or special order.



Powders

Item #	Description	Form	Formula	Catalog Pack Sizes
44931	Aluminum oxide, NanoDur®, 99.5%	45nm APS Powder, S.A. 36m ² /g	Al ₂ O ₃	100g / 500g
	<i>NanoDur® aluminum oxide is designed for coatings where transparency is of utmost importance. NanoDur® aluminum oxide is especially suited for enhancing abrasion resistance with minimal effects on clarity, gloss and physical properties of the coatings as well as for composite reinforcement, catalyst support, dielectric and polishing applications.</i>			
44930	Antimony tin oxide, NanoArc®, 99.5%	15nm APS Powder, S.A. 60m ² /g	Sb ₂ O ₅ :SnO ₂ 10:90 wt%	25g / 100g / 500g
	<i>Moderately conductive particle. The incorporation of NanoTek® antimony tin oxide products in coating systems, films or composites may help in reducing the buildup of static charge.</i>			
45582	Bismuth(III) oxide, NanoArc®, 99.5%	38nm APS Powder, S.A. 18m ² /g	Bi ₂ O ₃	25g / 100g / 500g
	<i>X-ray opaque particle. NanoArc® bismuth oxide can be compounded into polymers or coating systems to increase opacity to x-rays, while the small particle size ensures minimal disruption of physical properties.</i>			
44895	Iron(III) oxide, cosmetic, NanoArc®	30nm APS Powder, S.A. 38m ² /g	Fe ₂ O ₃	25g / 100g / 500g
	<i>NanoArc® cosmetic iron oxide is an auburn material offering unique cosmetic qualities. The small particle size results in a strong color development combined with high translucency for a unique glowing look.</i>			
45007	Iron(III) oxide, industrial, NanoArc®	30nm APS Powder, S.A. 38m ² /g	Fe ₂ O ₃	25g / 100g / 500g
	<i>NanoArc® industrial iron oxide is a general purpose gamma-phase material suitable for use in catalytic applications such as ammonia synthesis and dehydrogenation reactions. Manufactured by growing nanocrystals rapidly in a high temperature gas phase condensation, these 30nm particles are fully crystalline and have high surface purity.</i>			
44896	Iron(III) oxide, magnetic, NanoArc®	30nm APS Powder, S.A. 38m ² /g	Fe ₂ O ₃	25g / 100g / 500g
	<i>NanoArc® magnetic iron oxide is a highly magnetic material in which the crystallites are >98% gamma-phase. This material is suitable for a variety of applications requiring strong magnetic properties and narrow particle distribution, including diagnostics, telecommunications, and data storage.</i>			
44897	Tin(IV) oxide, NanoArc®	16nm APS Powder, S.A. 55m ² /g	SnO ₂	25g / 100g / 500g
	<i>Nanocrystalline tin oxide is suitable for polishing and catalytic applications.</i>			
44898	Zinc oxide, NanoGard®	60nm APS Powder, S.A. 18m ² /g	ZnO	100g / 500g
	<i>NanoGard® zinc oxide provides effective UV attenuation while maintaining clarity in silky-smooth, non-sticky formulations.</i>			
45010	Zinc oxide, NanoGard®, low lead, 99+%	60nm APS Powder, S.A. 18m ² /g	ZnO	100g / 500g
	<i>NanoGard® zinc oxide provides effective UV attenuation while maintaining clarity in silky-smooth, non-sticky formulations. Certified to less than 10ppm lead.</i>			
44899	Zinc oxide, NanoTek®	60nm APS Powder, S.A. 18m ² /g	ZnO	100g / 500g
	<i>NanoTek® zinc oxide, due to the small particle size, can provide UV protection while maintaining a high level of transparency in coatings, polymers, caulks, adhesives and other resin systems.</i>			
44900	Zinc oxide, NanoTek® C1, 99%, organosilane coated, hydrophobic, nonpolar	60nm APS Powder, S.A. 18m ² /g	ZnO	100g / 500g
	<i>NanoTek® zinc oxide C1 has a hydrophobic, nonpolar organosilane coating to aid dispersing in organic systems.</i>			
44901	Zinc oxide, NanoTek® C2, 99%, organosilane coated, hydrophobic, polar	60nm APS Powder, S.A. 18m ² /g	ZnO	100g / 500g
	<i>NanoTek® zinc oxide C2 has an oleophilic, polar coating to aid dispersing in organic systems.</i>			
45849	Zinc oxide, NanoArc® ZN-2500	50nm APS Powder	ZnO	100g / 500g
	<i>NanoArc® Extra High Transparency zinc oxide, due to the small particle size, can provide UV protection while maintaining a high level of transparency in coatings, polymers, caulks, adhesives and other resin systems.</i>			

Dispersions

Item #	Description	Form	Formula	Catalog Pack Sizes
45405	Aluminum oxide, NanoArc® R1121W, 30% in H ₂ O, colloidal dispersion with dispersant <i>Water borne aluminum oxide dispersion suitable for incorporation in water compatible coatings. The 20 nm average particle size alumina provides the maximum in optical clarity.</i>	20nm APS for dry powder (typical)	Al ₂ O ₃	100g / 500g / 2kg
44925	Aluminum oxide, NanoDur™ X1121W, 50% in H ₂ O, colloidal dispersion with dispersant <i>Aluminum oxide water borne dispersion suitable for incorporation in water compatible coatings or certain acidic polishing applications.</i>	45nm APS for dry powder (typical)	Al ₂ O ₃	100g / 500g
44908	Aluminum oxide, NanoTek® AL-6051, 23% in H ₂ O, colloidal dispersion <i>Aluminum oxide water borne dispersion suitable for use in ultrafine acid side polishing slurries.</i>	45nm APS for dry powder (typical)	Al ₂ O ₃	100g / 500g / 2kg
44907	Aluminum oxide, NanoTek® AL-6081, 23% in H ₂ O, colloidal dispersion with dispersant <i>Aluminum oxide water borne dispersion suitable for use in ultrafine acid side polishing slurries.</i>	45nm APS for dry powder (typical)	Al ₂ O ₃	100g / 500g / 2kg
45406	Aluminum oxide, NanoArc® R1130PMA, 30% in 1,2-propanediol monomethyl ether acetate, colloidal dispersion w/ dispersant <i>Aluminum oxide dispersion in Dowanol® PMA suitable for incorporation in a wide variety of organic-based coatings formulations. The 20 nm average particle size alumina provides the maximum in optical clarity.</i>	20nm APS for dry powder (typical)	Al ₂ O ₃	100g / 500g
44926	Aluminum oxide, NanoDur™ X1130PMA, 50% in 1,2-propanediol monomethyl ether acetate, colloidal dispersion <i>Aluminum oxide dispersion in Dowanol® PMA suitable for incorporation in a wide variety of coatings formulations</i>	45nm APS for dry powder (typical)	Al ₂ O ₃	100g / 500g
45586	Aluminum oxide, NanoArc® AL-2220, 30% in mineral spirits, colloidal dispersion with dispersant <i>Aluminum oxide dispersed in mineral spirits suitable for incorporation in non-polar organic based coatings and formulations where high transparency is important.</i>	20nm APS for dry powder (typical)	Al ₂ O ₃	100g / 500g
45790	Aluminum oxide, NanoDur® AL-2420, 50% in mineral spirits, colloidal dispersion with dispersant <i>Aluminum oxide dispersed in mineral spirits suitable for incorporation in non-polar organic based coatings and formulations.</i>	45nm APS for dry powder (typical)	Al ₂ O ₃	100g / 500g
44909	Cerium(IV) oxide, NanoTek® CE-6042, 18% in H ₂ O, colloidal dispersion <i>Cerium oxide water borne dispersion suitable for use in ultrafine acid side polishing slurries.</i>	48nm APS for dry powder (typical)	CeO ₂	100g / 500g / 2kg
44911	Cerium(IV) oxide, NanoTek® CE-6082, 18% in H ₂ O, colloidal dispersion with dispersant <i>Cerium oxide water borne dispersion suitable for use in ultrafine alkaline side polishing slurries.</i>	48nm APS for dry powder (typical)	CeO ₂	100g / 500g / 2kg
44910	Cerium(IV) oxide, NanoTek® CE-6080, 20% in H ₂ O, colloidal dispersion in water with dispersant <i>Cerium oxide water borne dispersion suitable for use in alkaline side polishing slurries. Submicron particle size makes for good removal rate with minimal subsurface damage.</i>	850nm APS for dry powder (typical)	CeO ₂	100g / 500g / 2kg
45588	Zinc oxide, NanoTek® ZN-2551, 50% in H ₂ O, colloidal dispersion with dispersant <i>Water borne zinc oxide dispersion suitable for incorporation in water compatible coatings and formulations.</i>	50nm APS for dry powder (typical)	ZnO	100g / 500g

Item #	Description	Form	Formula	Catalog Pack Sizes
44904	Zinc oxide, NanoShield® ZN-2000, 50% in H ₂ O, colloidal dispersion with nonionic dispersant <i>Zinc oxide water borne dispersion suitable for incorporation in water compatible coatings and paints.</i>	60nm APS for dry powder (typical)	ZnO	100g / 500g
45009	Zinc oxide, NanoShield® ZN-3008C, 50% in H ₂ O, colloidal dispersion with cationic dispersant <i>NanoShield® ZN-3008C is a cationic dispersion of zinc oxide in water designed to be incorporated in coatings applied to a fabric or non-woven substrates. Zinc oxide is generally used to provide UVA and UVB blocking, as well as anti-reddening and anti-inflammatory skin effects, antimicrobial activity, and odor control.</i>	60nm APS for dry powder (typical)	ZnO	100g / 500g
45012	Zinc oxide, NanoShield® ZN-3014A, 50% in H ₂ O, colloidal dispersion with anionic dispersant <i>NanoShield® ZN-3014A is an anionic dispersion of zinc oxide in water designed to be incorporated in coatings applied to a fabric or non-woven substrates. Zinc oxide is generally used to provide UVA and UVB blocking, as well as anti-reddening and anti-inflammatory skin effects, antimicrobial activity, and odor control.</i>	60nm APS for dry powder (typical)	ZnO	100g / 500g
45006	Zinc oxide, NanoShield® ZN-2001, 50% in H ₂ O, colloidal dispersion with dispersant and rheology modifier	70nm APS for dry powder (typical)	ZnO	100g / 500g
45632	Zinc oxide, NanoArc® ZN-2225, 40% in 1,2-propanediol monomethyl ether acetate, colloidal dispersion with dispersant <i>Zinc oxide dispersed in Dowanol® PMA suitable for incorporation in a wide variety of polar organic based coatings and formulations where high transparency is important.</i>	20nm APS for dry powder (typical)	ZnO	100g / 500g
45646	Zinc oxide, NanoTek® ZN-2525, 40% in 1,2-propanediol monomethyl ether acetate, colloidal dispersion with dispersant <i>Zinc oxide dispersed in Dowanol® PMA suitable for incorporation in a wide variety of polar organic based coatings and formulations</i>	50nm APS for dry powder (typical)	ZnO	100g / 500g
44924	Zinc oxide, NanoTek® Z1102PMA, 50% in 1,2-propanediol monomethyl ether acetate, colloidal dispersion with dispersant <i>Zinc oxide dispersion in Dowanol® PMA suitable for incorporation in a wide variety of coatings formulations.</i>	60nm APS for dry powder (typical)	ZnO	100g / 500g / 2kg
45683	Zinc oxide, NanoArc® ZN-2210, 40% in mineral spirits, colloidal dispersion with dispersant <i>Zinc oxide dispersed in mineral spirits suitable for incorporation in a wide variety of non-polar organic based coatings and formulations where high transparency is important.</i>	20nm APS for dry powder (typical)	ZnO	100g / 500g
45801	Zinc oxide, NanoTek® ZN-2610, 50% in mineral spirits, colloidal dispersion with dispersant <i>Zinc oxide dispersed in mineral spirits suitable for incorporation in a wide variety of non-polar organic based coatings and formulations.</i>	60nm APS for dry powder (typical)	ZnO	100g / 500g
45410	Zinc oxide doped with silver, NanoTek® ZnO:Ag-W, 50% in H ₂ O, colloidal dispersion <i>NanoTek® ZnO:Ag-W is a mixture of zinc oxide and stabilized silver that can be readily added to a variety of water-based formulations.</i>	70nm APS for dry powder (typical)	ZnO doped with Ag	100g / 500g

NanoArc, NanoGard, NanoTek, NanoDur and NanoShield are all registered trademarks of Nanophase Technologies Corporation. Dowanol is a registered trademark of Dow Chemical Company.



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