NANOSHEL LLC
3422 Old Capitol Trial Suit 1305
Willmington DE - 19808, United States
Phone : +1 302 268 6163
Fax: +1 302 996 5818
E-mail: sales@nanoshel.com
Web : www.nanoshel.com

Intelligent Material Pvt. Ltd.
Plot No. 117, Industrial Area, Ph-2,
Panchkula 134109 Haryana (India)
Phone: +91 9779880077, +91 9569591212
Fax: +91 22 66459880
Email: nanoshel2@gmail.com
Web : www.nanoshel.in

NANOSHEL®
Creating Miracles in Black

Product Catalogue

New Era of Nano Applications....!

Future is Nanoshel

Nanoshel Catalogue has a straightforward aim—to acquaint you with the whole idea of Nano science and nanotechnology. This comprises the fabrication and understanding of matter at the ultimate scale at which nature designs: the molecular scale. Nano science occurs at the intersection of traditional science and engineering, quantum mechanics, and the most basic processes of life itself. Nanotechnology encompasses how we harness our knowledge of Nano science to create materials, machines, and devices that will fundamentally change the way we live and work.

Big Things Come in Nano-Sized Packages

Nanoshel LLC is a Wilmington, Delaware based nanotechnology company specializing in the commercialization of wide range of Nanoparticles and Innovative materials of 21st century. Nanoshel is revolutionizing nanomaterials where traditional materials fall short.

Since 2005, Nanoshel has been exploring markets, developing innovative technologies, and providing breakthrough solutions using our Nanomaterial expertise.

What's interesting about materials on the Nano scale — contrary to popular belief is that size really does matter. That's because when familiar materials are reduced to Nano proportions, they begin to develop odd properties. For example, plastics can conduct electricity, gold particles can appear red or green and solids can turn into liquids almost spontaneously at room temperature. While not all matter is subject to change, the manipulation of such Nano change is a cornerstone of nanotechnology research.

At the Nano scale, substances may behave differently or better compared to the same substances at macro sizes. For instance, Gold can change Colour, Carbon can conduct heat and electricity better Silver has improved antimicrobial properties.

Other changes that occur to substances at the Nano scale can include: Becoming super-elastic, Becoming more chemically reactive, Getting physically stronger or weaker, Being able to cope with massive changes in temperature and pressure.

It's because of these unique properties that nanotechnology could be used in such a huge range of products.

This catalogue discuss nanotechnology and its impact on almost every industry, including computers, semiconductors, pharmaceuticals, defense, health care, communications, transportation, energy, environmental sciences, entertainment, chemicals, and manufacturing. This merging of different fields will result in developments that are not simply evolutionary; they will be revolutionary

If you want to buy nanomaterial's or discuss nanotechnology applications, you can also visit our Web site at www.nanoshel.com.

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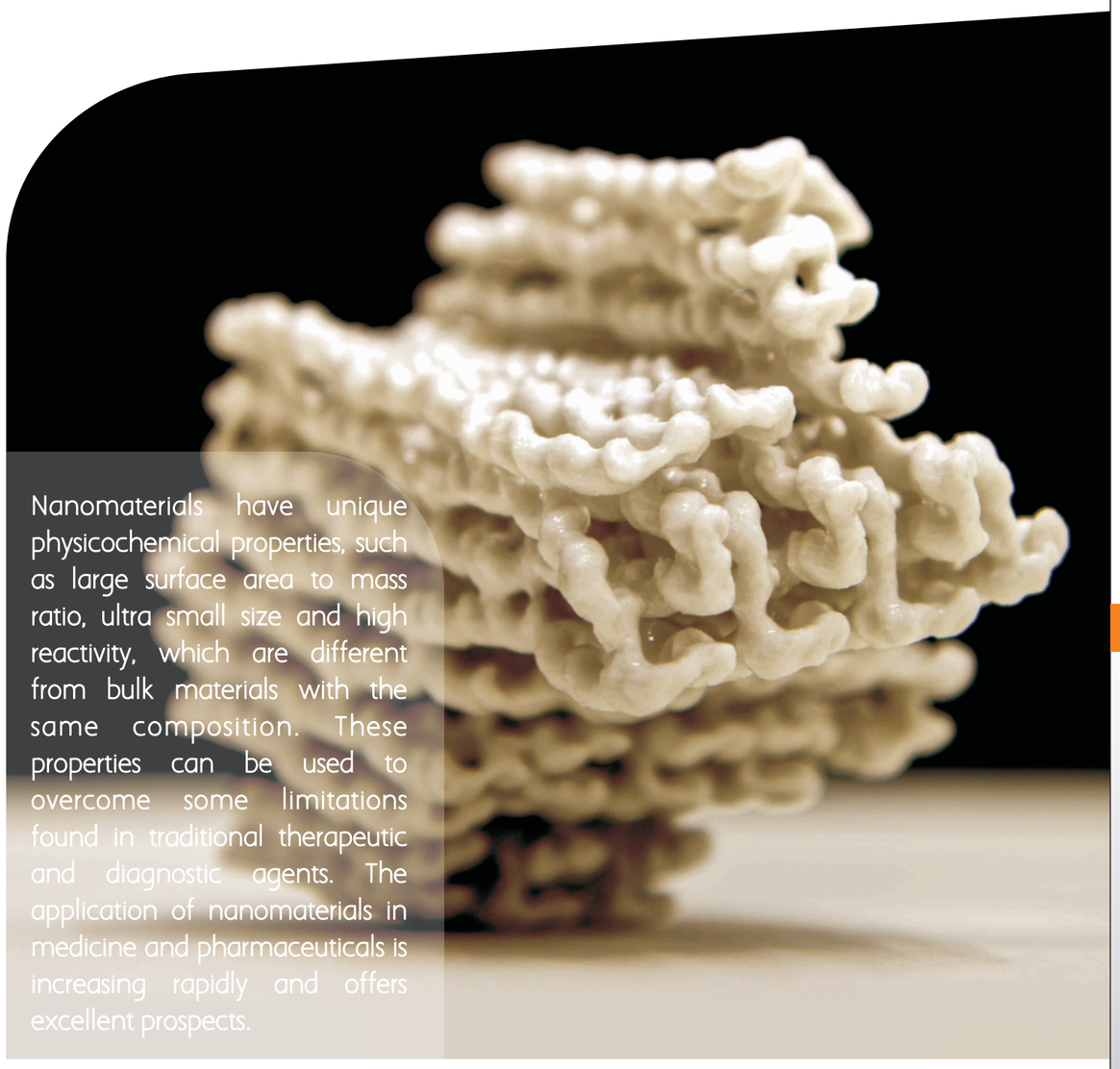
NANOSHEL®
Creating Miracles in Black

Nano Medicine

Intelligent nano materials for medicine | Nano-Gold Conjugation | Diagnostics
Targeted Drug Delivery | Tissue Engineering & Regenerative Medicine

Nanobased Medical Treatment

Nano Medicine
Intelligent nano materials for medicine



Nanomaterials have unique physicochemical properties, such as large surface area to mass ratio, ultra small size and high reactivity, which are different from bulk materials with the same composition. These properties can be used to overcome some limitations found in traditional therapeutic and diagnostic agents. The application of nanomaterials in medicine and pharmaceuticals is increasing rapidly and offers excellent prospects.

Nanomaterials have unusual mechanical, optical, electrical and chemical behaviors, they have been widely used in medicine and pharmaceuticals for the sensitive detection of key biological molecules, more precise and safer imaging of diseased tissues and novel forms of therapeutics etc. In the last two decades, a number of nanoparticle-based therapeutic and diagnostic agents have been developed for the treatment of cancer, diabetes, pain, asthma, allergy, infections, and so on.

For questions, product data, or new product suggestions, please contact NANOSHEL at info@nanoshel.com

Nano Medicine
Nano-Gold Conjugation

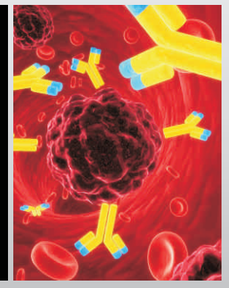
Nano GOLD products are 'conjugation friendly' nanoparticles with a proprietary surface coat that greatly enhances colloidal stability and permits easy covalent attachment of a variety of molecules, including antibodies, analytes and other biomolecules.

In the case of immuno-gold conjugates, the antibody can be attached irreversibly without the need for extensive trials at different values of pH and/or salt concentration, as is typical of traditional 'passive' binding methods.

In the case of analyte-gold conjugates, the multipoint attachment of the polymer to the gold surface ensures that the analyte is firmly anchored. By contrast, direct attachment of analytes to gold surfaces by self-assembly techniques is far less stable and unwanted desorption is a significant problem.
Nano GOLD nanoparticles can be provided in a variety of formats (e.g. 10 OD liquid or as lyophilized nanoparticles) formulated to allow a one-step reaction with antibodies.

The kits available are designed for research use and for the development of diagnostic products, specifically for the screening of potential antibodies or small scale 'proof of principle' studies. Please contact us if you require any additional information and to discuss your bulk or custom conjugation requirements.

Features	Benefits
Proprietary surface coat	Antibody-GOLD conjugates in just 15 minutes
Ultra-stable	Enhanced assay sensitivity
Covalently link antibodies and analytes	Protective coat prevents metal-antibody interactions
Simple conjugation processes	Rapid screening of multiple antibodies for assay development
Different surface chemistries	No pH titrations
Custom labeling service available	Fully scalable - from R&D to Production
	Custom Nano labeling services



Nano Medicine
Diagnostics

A major emphasis in bioengineering and medical technology has improved diagnostic techniques to screen for disease. Such screening is required to identify illnesses, assess risk of disease onset, or determine progression or improvement of disease state such as cancer, stroke, Alzheimer's, or cardiac disease. Nanotechnology may improve the sensitivity, selectivity, speed, cost, and convenience of diagnosis. Individual biomolecular interactions can be detected by the deflection of a microcantilever, the red-shifted emission of a gold nanoparticle, or the altered conductance of a nanowire. Nanoscale labeling agents, such as quantum dots, have numerous advantages to intracellular labeling and visualization. Nanotechnology has opened up the possibility of other screening strategies as well.

Faster,less expensive medical diagnostics through nanotechnology

Stock Number	Product Description	Application
NS6130-01-108	Gold Nanopowder (Au, 99+%, 50-100nm)	Biomolecular Interactions
NS6130-01-109	Gold Nanopowder (Au, 99+%, <80nm)	Biomolecular Interactions
NS6130-02-253	Cadmium Sulphide (CdS, 99+%, 5-10nm)	DNA Targets
NS6130-02-288	Zinc Sulphide (ZnS, 99+%, 5-10nm)	Optical Detection & Visualization
NS6130-03-311	Copper Oxide (CuO, 99+%, 80nm)	Optical Detection & Visualization
NS6130-02-240	Lead Sulphide (PbS, 99+%, 80nm)	Optical Detection & Visualization
NS6130-06-601	Carbon Nanotubes (SWCNT, 99+%, OD: 2-3nm)	Electrical Detection

Nanotechnology-on-a-chip is one more dimension of lab-on-a-chip technology. Magnetic nanoparticles, bound to a suitable antibody, are used to label specific molecules, structures or microorganisms. Gold nanoparticles tagged with short segments of DNA can be used for detection of genetic sequence in a sample. Multicolor optical coding for biological assays has been achieved by embedding different-sized quantum dots into polymeric microbeads. Nanopore technology for analysis of nucleic acids converts strings of nucleotides directly into electronic signatures.

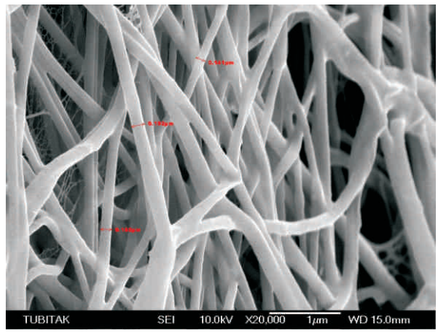
Nano Medicine
Targeted Drug Delivery

Nanoparticles, which have diameters under 100nm, or one-thousandth of a millimeter, are thought to be the most promising drug carriers. It's hard for a white blood cell to understand, it has a nanoparticle next to it. Those same tiny dimensions allow them to slip through the cracks between cells and infiltrate cell membranes, where they can go to work administering medicine.

Stock Number	Product Description	Application
NS6130-03-320	Iron Oxide Nanopowder (Fe_2O_3, gamma, 99%, <40nm)	Cell Imaging
NS6130-03-321	Iron Oxide Nanopowder (Fe_3O_4, high purity, 99.5%, 80nm)	Cell Imaging
NS6130-01-108	Gold Nanopowder (Au, 99+%, 50-100nm)	Therapeutic Applications
NS6130-01-109	Gold Nanopowder (Au, 99+%, <80nm)	Target Drug Delivery
NS6130-01-104	Silver Nanopowder(Ag 99%, 20nm, metal basis)	Biosensing

Nano Medicine
Tissue Engineering & Regenerative Medicine

Nanotechnology can help reproduce or repair damaged tissue. “Tissue engineering” makes use of artificially stimulated cell proliferation by using suitable nanomaterial-based scaffolds and growth factors. For example, bones can be regrown on carbon nanotube scaffolds. Tissue engineering might replace today’s conventional treatments like organ transplants or artificial implants. Advanced forms of tissue engineering may lead to life



Nanomaterials can also compensate for limitations in the scaffold. Embedding nanoparticles in biomaterials can enhance their mechanical and electrical conductive properties, for example. Nanomaterials can also increase cell viability, promote adhesion, control the release of growth factors and cytokines, and even physically shape biomaterials and cells to create a desired tissue structure.

Ultimately, smart controllable nanorobots could potentially go to work for us — circulating inside the body, finding diseased tissues and repairing them by destroying defected cells and molecules or by encouraging cells to regain their function. We believe that these tiny nanostructures could redefine medicine in the future. It’s a future and we should look forward to being a part of.

Nanoshel Carbon nanotubes/nanofibers (CNTs/CNFs) are good scaffold candidates for bone tissue engineering applications due to their superior cytocompatible, mechanical and electrical properties. It was seen that a 60nm diameter CNFs stimulated osseointegration by significantly increasing osteoblast adhesion and decreasing competitive cell adhesion. Nanoshel CNT/CNF reinforced polymer nanocomposites have demonstrated excellent electrical conductivity for tissue regeneration. An 80%/20% polylactic acid (PLA)/CNT composite exhibited ideal electrical conductivity for bone growth in comparison to PLA which acted as an insulator. Thus CNTs/CNFs can act as osteogenic scaffolds with superior properties to effectively enhance bone regeneration.

Stock Number	Product Description	Application
NS6130-09-919	Hydroxyapatite Nano Powder (99%, 50nm)	Bone Tissue Engineering
NS6130-09-924	Hydroxyapatite silver coated (99%, 200nm)	Bone Forming (Osteoblast) Cells
NS6130-09-918	Chitosan Nanofibers (99%, 100nm)	Bone Tissue Engineering
NS6130-09-925	Gelatin Nano Powder (99%, 100nm)	Encapsulating Stem Cells
NS6130-09-926	Collagen Nano Powder (99%, 80nm)	Bone Tissue Engineering

For questions, product data, or new product suggestions, please contact NANOSHEL at info@nanoshel.com

Nano EnviroNment
Water Filteration | Polution Detection | Water Treatment Technologies

Nanobased Treatment Technologies

Nano Environment
Filtration

In terms of wastewater treatment, nanotechnology is applicable in detection and removal of various pollutants. Heavy metal pollution poses as a serious threat to environment because it is toxic to living organisms, including humans, and not biodegradable. Various methods such as Photocatalysis, Nanofiltration, Adsorption, and Electrochemical oxidation involve the use of TiO_2, ZnO, ceramic membranes, nanowire membranes, polymer membranes, carbon nanotubes, submicron nanopowder, metal (oxides), magnetic nanoparticles, nanostructured boron doped diamond are used to resolve or greatly diminish problems involving water quality in natural environment.

Most environmental applications of nanotechnology fall into three categories: (i) environmentally-benign and/or sustainable products (e.g. green chemistry or pollution prevention), (ii) remediation of materials contaminated with hazardous substances, and (iii) sensors for environmental agents. In particular, nanotechnologies play a large role in current efforts to develop better methods for detection and decontamination of harmful biological agents, which are in many respects environmental issues.

Stock Number	Product Description	Application
NS6130-03-350	Titanium Oxide Nanopowder (TiO_2, anatase, 99+%, 10-25 nm)	Water Purification
NS6130-03-362	Zinc Oxide Nanopowder (ZnO, 99+%, 10-30 nm)	Degradation of Contaminants
NS6130-03-306	Cerium Oxide Nanopowder (CeO_2, 99%, <80nm)	Water Purification
NS6130-01-115	Diamond Nanopowder (C, 55-60%, 3-10 nm)	Remove Contaminants
NS6130-03-321	Iron Oxide Nanopowder (Fe_3O_4, high purity, 99.5+%, 80nm)	Decontamination
NS6130-09-918	Chitosan Nanofibers (99%, 100nm)	Adsorbent of Contaminants
NS6130-01-103	Silver Nanopowder(Ag 99%, 30-50nm, metal basis)	Antibacterial Activity

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Nano Environment
Polution Detection & Sensing

Nanostructure material	Function
Silver nanoparticle array membranes	Water quality monitoring
Carbon nanotubes (CNTs)	Electrochemical sensors
CNTs as a building block	Exposure to gases such as NO_2, NH_3 or O, the electrical resistance of CNTs changes dramatically, induced by charge transfer with the gas molecules or due to physical adsorption
CNTs with enzymes	Establish a fast electron transfer from the active site of the enzyme through the CNT to an electrode, in many cases enhancing the electrochemical activity of the biomolecules
CNTs sensors	Developed for glucose, ethanon, sulphide and sequence specific DNA analysis
Magnetic nanoparticles coated with antibodies	Useful for the rapid dection of bacteria in complex matrix

Air pollution can be remediated using nanotechnology in several ways. One is through the use of nano-catalysts with increased surface area for gaseous reactions. Catalysts work by speeding up chemical reactions that transform harmful vapors from cars and industrial plants into harmless gases. Catalysts currently in use include a nanofiber catalyst made of manganese oxide that removes volatile organic compounds from industrial smokestacks. Other methods are still in development.

Nano Sensors

The characterization of environmental sensors is based primarily on the physics involved and their operating mechanisms. For example, chromatography relies on the separation of complex mixtures by percolation through a selectively adsorbing medium with subsequent detection of compounds of interest. Electrochemical sensors include sensors that detect signal changes (e.g. resistance) caused by an electric current being passed through electrodes that interact with chemicals. Mass sensors rely on disturbances and changes to the mass of the surface of the sensors during interaction with chemicals. Optical sensors dectet changes in visible light or other electromagenetic waves during interactions with chemicals. Within each of these categories, some sensors may exhibit characteristic that overlap with those of other categories. For example, some mass sensors may rely on electrical excitation or optical settings.

Types of sensors: Biosensors, Electrochemical Sensors, Mass Sensors, Optical Sensors, Gas Sensors

Stock Number	Product Description	Application
NS6130-03-350	Titanium Oxide Nanopowder (TiO_2, anatase, 99+%, 10-25 nm)	Oxidative Transformation
NS6130-03-362	Zinc Oxide Nanopowder (ZnO, 99+%, 10-30 nm)	Photocatalysis Oxidation
NS6130-01-133	Iron Nanopowder (Fe, 99+%, 60-80 nm)	Destroying Contaminants
NS6130-06-601	Carbon Nanotubes (SWCNT, 99+%, OD: 2-3nm)	Destroying Contaminants

Nano Environment
Water Treatment Technologies

Carbon Nanotube Based Technologies
Carbon nanotubes can be uniformly aligned to form membranes with nanoscale pores that are able to filter out contaminants. Their nanoscale pores make these filters more selective than other filtration technologies. The carbon nanotubes also have high surface areas, high permeability, and good mechanical and thermal stability.120 Though several other methods have been used, carbon nanotube membranes can be made by coating a silicon wafer with a metal nanoparticle catalyst that causes carbon nanotubes to grow vertically aligned and tightly packed. The spaces between the carbon nanotubes can then be filled with a ceramic material to add stability to the membrane.

Amount of Water Treated
Although their pores are significantly smaller, carbon nanotube membranes have been shown to have the same or faster flow rates as much large pores, possibly because of the smooth interior of the nanotubes.

Contaminant Removal
Laboratory studies report that carbon nanotube membranes can remove almost all kinds of water contaminants, including turbidity, bacteria, viruses, and organic contaminants. These membranes have also been identified as promising for desalination and as an alternative to reverse osmosis membranes.

Other Nanofiltration Approaches
- Nanofiltration Membranes and Device
- Nanofibrous Alumina Filters
- Nanofiber Gravity Flow Devices
- Nanoporous Ceramics, Clays and Other Adsorbents
- Nanoporous Ceramic Bio Media Filtration
- Nanoporous Ceramic Membrane Filter
- Cyclodextrin Nanoporous Polymer
- Polypyrrole Carbon Nanotube Nanocomposite

Nano Zeolites
Natural, Synthetic, Coal Fly Ash, and Compound Zeolites

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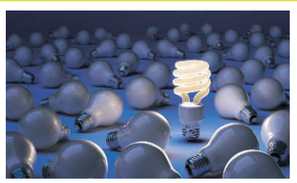
Nano Energy

Reduction in Energy Consumption | Increasing the Efficiency of Energy Production

Energy Storage Through Graphene | Effect of Nanotechnology on CO_2 Emission | Graphene



Nanobased Increased Energy Efficiency

Nano Energy
Reduction in Energy Consumption

New nanotechnology applications are underway in the energy sector. Better energy production, storage, transmission and usage are possible with nanotechnology.

Nanotechnology refers to any technology that includes components that are smaller than 100 nanometers. A nanometer is one billionth of a meter. A single virus measures approximately 100 nanometers. Science and engineering are working to develop new nanomaterials in the energy sector that may improve energy efficiency, storage, conversion, consumption, and better renewable energy sources

Batteries

Currently, the large number of used batteries and accumulators represent an environmental problem. Nanomaterials could help develop batteries with higher energy capacities or rechargeable batteries and accumulators, which will help with the disposal issue of batteries. For example, Researchers at Stanford University have found a way to use silicon-based nanowires to increase significantly the capacity of rechargeable lithium-ion batteries that currently power-up electronic devices such as laptops, video cameras, cell phones, and many others. In fact, the new technology, known as Li-ion, can increase 10 times the capacity of traditional Lithium batteries. Also, Silicon Nanopowder can reduce the possibility of batteries catching fire by providing less flammable electrode materials.

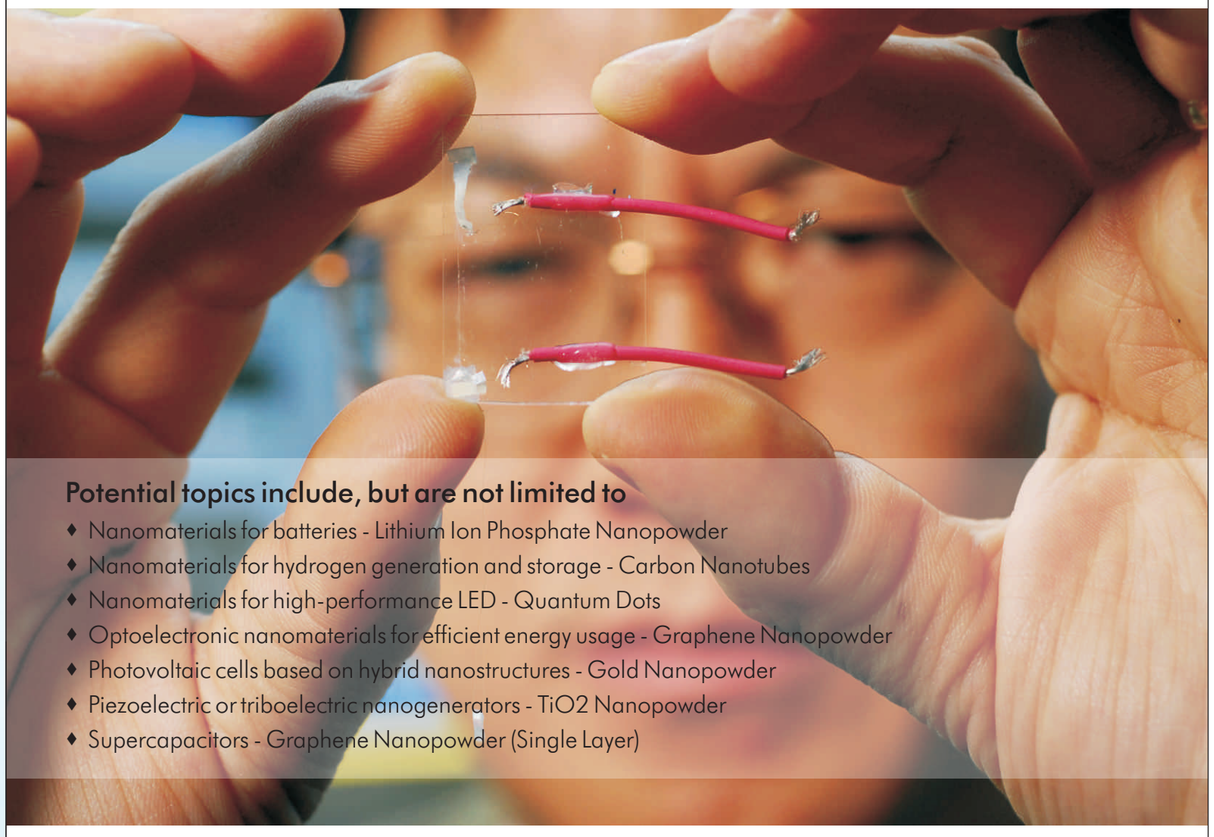
Stock Number	Product Description	Application
NS6130-02-269	Lithium Iron phospate Nanopowder (LIP, 99%, <40nm)	Energy Storage
NS6130-03-640	Carbon Nanotubes (MWCNT, OD: 20-30nm, 99%)	Increases Rate of Energy Trf
NS6130-03-350	Titanium Oxide Nanopowder (TiO_2, anatase, 99+%, 10-25 nm)	Synthesis Properties
NS6130-01-141	Silicon Nanopowder (Si, 99+%, <100 nm, Monocrystalline)	Energy Transfer

Nanomaterials Application

Fe-Ni Alloy Nanopowder	High-Power Magnets
Carbon Nanotubes	High-Sensitivity Sensors
Silicon Nanopowder	Next-Generation Computer Chips
Graphene	Better Insulation Materials
Phosphors Nanopowder	Phosphors for High-Definition TV
Nano Based LED's	Low-Cost Flat-Panel Displays
Diamond Nanopowder	Tougher and Harder Cutting Tools
LiFePo4 Nanopowder	High Energy Density Batteries

Nano Energy
Increasing the Efficiency of Energy Production

Energy generation and storage are perhaps two of the most imperative, on-going, and challenging issues facing the world to date. Rapidly growing global energy demands place increasingly greater burdens on the incumbent fossil fuel-based infrastructure. This has resulted in a switch toward both the exploration of new and clean energy sources and the development of highly efficient energy storage devices. Nanomaterials and nanodevices are expected to play a key role in this paradigm shift. However, breakthroughs are needed in our abilities to synthesize nanomaterials and atomistic assembly, to study energy transduction at nanoscale, and to understand the underlying chemical and physical mechanism involved in high-efficient energy conversion and storage. This Energy Section focuses on the science and engineering of nanomaterials and nanodevices used in all forms of energy harvesting, conversion, storage, and utilization.



Potential topics include, but are not limited to

- Nanomaterials for batteries - Lithium Ion Phosphate Nanopowder
- Nanomaterials for hydrogen generation and storage - Carbon Nanotubes
- Nanomaterials for high-performance LED - Quantum Dots
- Optoelectronic nanomaterials for efficient energy usage - Graphene Nanopowder
- Photovoltaic cells based on hybrid nanostructures - Gold Nanopowder
- Piezoelectric or triboelectric nanogenerators - TiO2 Nanopowder
- Supercapacitors - Graphene Nanopowder (Single Layer)

Reduction of Energy Consumption

Reduction of energy consumption is an active area in nanotechnology. Energy reduction using nanotechnology targets the development of more efficient lighting, better combustion systems, use of lighter and stronger materials in the transportation sector. Light-emitting diodes (LEDs) or quantum caged atoms (QCAs) are interesting applications for energy consumption reduction.

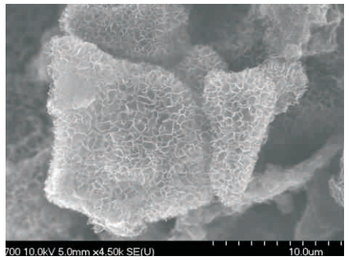
Nano Energy
Energy Storage Through Graphene

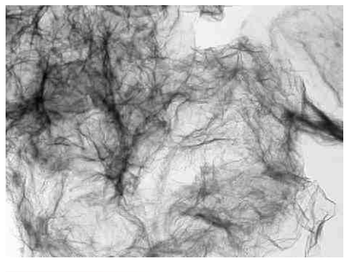
An entirely new strategy for engineering graphene-based supercapacitors has been developed by researchers potentially leading the way to powerful next-generation renewable energy storage systems. The new strategy also opens up the possibility of using graphene-based supercapacitors in electric vehicles and consumer electronics.

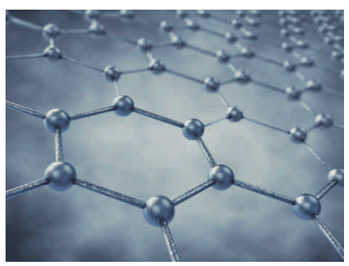
Supercapacitors which are typically composed of highly porous carbon that is impregnated with a liquid electrolyte are known for possessing an almost indefinite lifespan and the impressive ability to recharge extremely rapidly, in seconds even. But existing versions also possess a very low energy-storage-to-volume ratio in other words, a low energy density. Because of this low energy density 5-8 Watt-hours per liter in most supercapacitors they're not practical for most purposes. They would either need to be extremely large or be recharged very, very often for most uses.

The world's largest producer of nano graphene platelets (NGPs), Nanoshel single layer graphene has exhibited high electrical properties including exceptional in-plane electrical conductivity (up to ~ 20,000 S/cm) when compared to other nanomaterials including carbon nanotubes (CNTs) and carbon nano-fibers (CNFs). Products targeted include a wide range of consumer electronics including smart phones and other portable electronics, computer peripherals, touchpad's, POS kiosks, and industrial controls.

NANOSHEL offers a variety of graphene materials in sizes ranging from nano to micron in the x, y, and z axis. These advanced materials are collectively referred to as nano graphene platelets (NGPs). NGPs offer improved material performance and superior mechanical, thermal, barrier, and electrical conductivity properties. As a result, Nanoshel is able to work with companies to functionalize graphene for specific applications that include batteries, fuel cells, supercapacitors, light weight structural components as well as electromagnetic interference (EMI), radio frequency interference (RFI), electrostatic discharge (ESD), lightning strike, and other functional and structural composite applications.

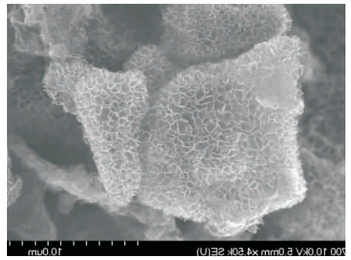


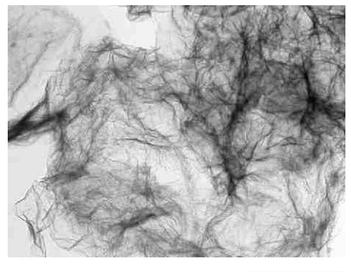


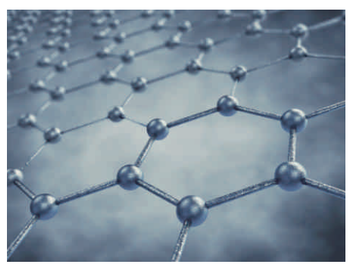


Stock Number	Product Description	Application
NS6130-03-364	Graphene Nanopowder (C,99%,Single Layer)	Super Capacitor
NS6130-03-365	Graphene Nanopowder (C,99%, 4-6 Layer)	Super Capacitor Battery
NS6130-03-371	Graphene Nanopowder (C,99%, Single Layer-Modified)	Transistors/ Electrodes

Nano Energy
Effect of Nanotechnology on CO_2 Emission







From an analysis of the impact of nanotechnologies on Co2 emissions, it is clear that nanotechnologies provide a piece of the solution, but not the entire one. Currently available technologies have the potential to directly reduce carbon emissions by almost 200,000 tons by 2020, chiefly through weight savings and improved combustion in transport applications and through improvements in building insulation.

Impact of nanotechnologies in emission reductions

a) The reduction of emissions from transportation through weight reductionand improved drive train efficiency. The traditional automotive industry rule of thumb is that a 10% reduction in weight gives a 5% increase in fuel efficiency, but the adoption of Nanocomposites across the vehicle, from engine parts to body panels has increased this savings.

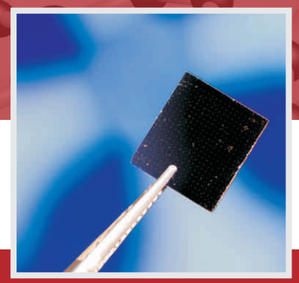
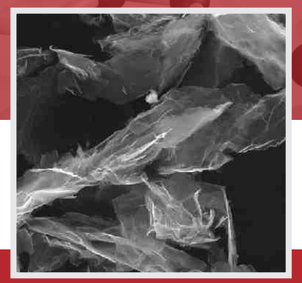
b) The use of improved insulation in residential and commercial buildings Nanomaterials are already being used to reduce the energy required for heating and cooling, and from manufactures estimates these materials are some 30% more efficient that current technologies (without taking into account lighter weight, the ability of materials such as aerogels to trap sunlight etc).

c) The generation of renewable photovoltaic energy. Thin film solar panels using flexible substrates will open up new application areas, but silicon based solar technologies, previously hampered by a shortage of silicon, a situation forecast to ease in 2008, are now promising far higher conversion efficiencies.

d) Nanoshel is working with technology companies in US and Europe in reduction of Co2 emmission with use of various nanomaterial nanotechnologies.

Stock Number	Product Description	Application
NS6130-01-101	Silver Nanopowder (Ag, 99%, 50-80 nm, metal basis)	Carbon Reduction
NS6130-03-353	Titanium Oxide Nanopowder (TiO_2, rutile, 96+%, 30nm coated with silicon)	Improve Insulation
NS6130-03-360	Zinc Oxide Nanopowder (ZnO, 99.9 +%,80-200nm)	Weight Reduction
NS6130-01-141	Silicon Nanopowder (Si, 99+%, <100 nm, Monocrystalline)	Improve Insulation

Nano Energy
Graphene


Electronic Property
One of the hottest areas of graphene research focuses on the intrinsic electronic properties; how electrons flow through a sheet – only one atom thick – while under the influence of various external forces.

Thermal and thermoelectric properties
Its thermal conductivity was measured recently at room temperature and it is much higher than the value observed in all the other carbon structures as carbon nanotubes, graphite and diamond (> 5000 W/m/K).

Mechanical properties
It was found that graphene is harder than diamond and about 300 times harder than steel. To put this into context, it will take the weight of an elephant balanced on a needle-point in order to break this one atom thick fabric! The tensile strength of graphene exceeds 1 Tpa.

Optical properties
Graphene, despite being the thinnest material ever made, is still visible to the naked eye. Due to its unique electronic properties, it absorbs a high 2.3% of light that passes through it, which is enough that you can see it in air (if you could manage to hold it up!).

Chemical Properties
Other than weakly attached adsobates, graphene can be functionalized by several chemical groups (for instances OH-, F-) forming graphene oxide and fluorinated graphene. It has also been revealed that single-layer graphene is much more reactive than 2, 3 or higher numbers or layers.

Stock Number	Product Description	Properties
NS6130-03-364	Graphene Nanopowder (Single Layer Flakes > 50%)	Unique Electronic Property
NS6130-03-365	Graphene Nanopowder (4 to 6 Layer Flakes > 80%)	300 Times Harder than Steel
NS6130-03-366	Graphene Nanopowder (Polymer Composite Material)	Functionalized by Several Chem. Group
NS6130-03-367	Graphene Nanopowder (Electrically Conductive Composites)	Intrinsic Electronic Property

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Nano Information & Communication

Transparent Conductive Displays | Conductive Carbon Nanotube Ink
Novel Semiconductor Devices | Novel Optoelectronic Devices | Memory Storage

Nanobased Sensing Technology

Nano Information & Communication
Transparent Conductive Displays

DISPLAYS

Innovating the world of nano materials to enable tomorrow's high-tech electronic designs

Transparent Conductive Films (TCFs) are used in most high-tech displays and touchscreens. Currently, the electronics industry relies primarily on Indium Tin Oxide (ITO) to make electro-conductive films for displays.

ITO / SWCNT in Transparent Conductive Display :

It is brittle, making it unsuitable for touchscreens and flexible displays The cost of processing ITO is very high. Single-walled carbon nanotubes (SWNT) are an ideal alternative, resolving the above challenges while offering exceptional electrical and mechanical properties. Up until now, however, their use was limited as a result of technical barriers. Nanoshel Nanomaterials has developed an innovative SWNT technology that overcome these barriers, enabling best-in-class transparent conductive thin films suited to a wide application spectrum including solar cells, touchscreens, displays, electrochromic windows and thin-film transistors.

A closer look SWNTs must be solubilised before they can be turned into TCFs. The sonication methods typically used to achieve this have the downside of limited scalability and damage to the SWNT structure. Nanoshel Nanomaterials has overcome these issues by eliminating the need for sonication, ultra centrifugation and functionalisation. Nanoshel innovative, scalable reductive dissolution technology uses liquid ammonia to produce solubilised carbon nanotubes in the form of inks, which can then be deposited as films. The negative charge on the SWNTs within the ink allows for further functionalisation, extending the field of potential applications to composites, sensors and biology.

Stock Number	Product Description	Application
NS6130-06-601	Carbon Nanotubes (SWCNT, 99+%, OD: 2-3nm)	Conductive Display
NS6130-02-226	Indium Tin Oxide Nanopowder (ITO, In_2O_3:SnO_2 90:10)	Conductive Display
NS6130-04-437	Graphene Dispersion Single Layer (C,20 wt%,Laitral Size:20nm)	Conductive Display

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Nano Information & Communication
Conductive Carbon Nanotube Ink

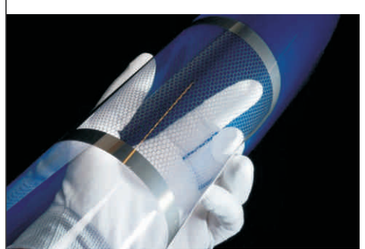
Carbon nanotubes are cylindrical nanostructured allotropes of carbon with unique properties. These carbon molecules have been extensively exploited for a variety of applications owing to their exceptional mechanical robustness, thermal conductivity, electronic transport and optical photoluminescence properties. One of its versatile applications is in the form of carbon nanotube ink, where carbon nanotubes are used in ink to print on paper and plastic surfaces. However, carbon nanotubes are difficult to manipulate and, have a propensity to aggregate and resist dispersion. Therefore, there is need for an easily dispersible carbon nanotube ink.

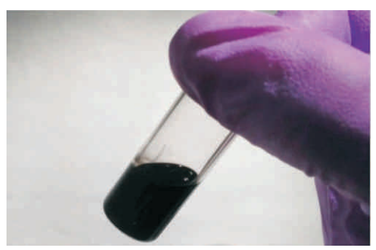
Advantages

1. Aqueous solutions of individually-dispersed (MWCNT Purity: 99% OD: 10-20nm, Length: 3-8um High Purity) have been prepared using the novel additive as a co-dispersant to concentration in the g.L range. The highest achieved concentration is 3.35 g/L, but much higher concentrations are possible.
2. This novel ink product is prepared in high enough concentrations to achieve the highest contrast ratio possible compared to other inks on the same substrate.

Applications

1. Ultra-high contrast ink: Using carbon nanotube ink prepared in high enough concentrations with the above method will allow for highest contrast ratio possible compared to other inks.
2. Conductive Inks: This novel ink has high concentrations of carbon nanotube (MWCNT Purity: 99% OD: 10-20nm, Length: 3-8um High Purity) solutions, some of which have high electrical conductivity, which is ideal for the conductive coatings that are important for the upcoming flexible electronics industry.
3. Transitive Inks (for Thin Film Transistors or TFTs): Certain species of carbon nanotubes (SWCNT, Purity: >98 wt%, OD: 1-2nm, Avg Length: 3-8um High Purity) are semiconductors. However, their properties are not discernable when they are generated along with a mixture of other carbon nanotube species. This novel ink allows the carbon nanotubes to be individually dispersed and retain their semiconductor properties when the ink is dry.
4. Document Security: The optical properties of nanotubes are intact due to their individually dispersed states. The unique photoluminescence properties in the near infra-red (NIR) spectral region can be used as document signatures or authentication marks. These features could be pre-built into the paper as a watermark or printed on the paper as an ink.





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Nano Information & Communication
Novel Semiconductor Devices

When the size of semiconductor materials reduces to nanoscale, their physical and chemical properties change dramatically, resulting in unique properties due to their large surface area or quantum size effect. Currently, semiconductor nanomaterials and devices are still in research stages, but they are promising for applications in many fields, such as solar cells, nanoscale electronic devices, light-emitting nano devices, laser technology, waveguide, chemical and biosensors, and catalysts. Further development of nanotechnology will certainly lead to significant breakthrough in semiconductor industry. Recently, strong attentions have been drawn in the research of silicon based nanostructures including silicon quantum dots and silicon nanowires. This field has become one of the most active research areas of semiconductor nanotechnology.

The targeted materials include: silicon nanowires (SiNWs) array, carbon nanotubes (CNTs) array, silicon quantum dots (SiQDs), carbon quantum dots (CQDs), organic/inorganic hybrid nanomaterials, heterojunction structures, and functional nanomaterials with nonlinear optic, humidity sensitive, thermal sensitive, gas sensitive, and magnetic properties.

Nano Particles Advantages for Polishing Slurries	
Al_2O_3 Nano	: Faster rate of surface removal reduces operating costs
CeO_2 Nano	: Less material required due to small size of particles

Stock Number	Product Description	Application
NS6130-01-141	Silicon Nanopowder (Si, 99+%, <100 nm, Monocrystalline)	Semiconductor
NS6130-01-142	Silicon Nanopowder (Si, 99+%, <80 nm, Monocrystalline)	Semiconductor
NS6130-06-601	SWCNT, >98 wt%, OD: 1-2nm, Avg Length: 3-8um High Purity	Wafer Polishing
NS6130-06-635	SWCNT NH_2 , 90-95wt% OD: 1-2nm, L: 15-30um, NH_2: 2-3Wt%	Wafer Polishing

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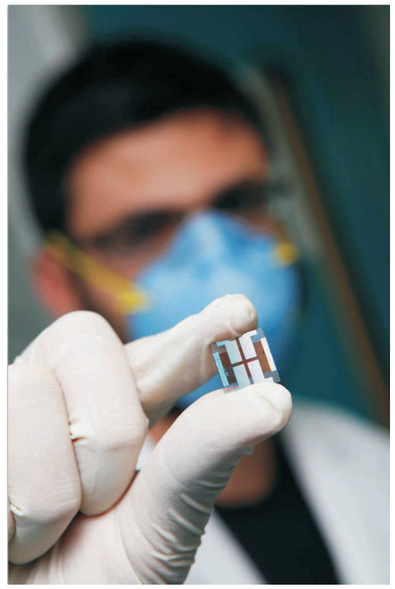
Nano Information & Communication
Novel Optoelectronic Devices



Single-crystal compound semiconductor nanowires can be grown on variety of substrates including Silicon nanopowder. Direct bandgap and higher mobility make them attractive for applications such as chip-to-chip optical interconnects, head-mount displays, sensors, and flexible electronics. They are also excellent vehicles for understanding how reduced dimensions affect electrical and optical properties.

Carbon nanotubes are rolled up sheets of graphene, a one atom thick layer of sp2 bonded carbon. Both nanotubes and graphene have unique and technologically attractive qualities, including high carrier mobility (2×105/V·sec), high sustained current density (109 A/cm2 vs. 106 A/cm2 for Cu), and no surface dangling bonds, so many high-k dielectrics can be readily used as gate oxides.

Graphene sheets can be produced by attaching a graphite microcrystal to an AFM tip (in inovation Material) and scratching it over a Si wafer. Although sufficient for basic research this method is not readily adapted to large scale device fabrication. Research Laboratory are making Graphene layers by heating SiC to ~1200oC, while monitoring this process using Low Energy Electron Microscopy

Nanoimprint lithography (NIL) is a quick way to nano-pattern a surface, well suited for large area repeating geometries such as lines and dots, as well as stand alone nanostructures such as nanogap electrodes. A 2D plasmonic grating is formed by imprinting nanoholes into PMMA and evaporating a thin metal layer over the pattern. By making this pattern on a thin actuator, we demonstrated an optical switch. A grating pattern of 200 nm pitch was used to make Si 'nanowire' with <70 nm diameter and 100 cm length, which served as excellent chemical sensors.

Stock Number	Product Description	Application
NS6130-03-364	Graphene Nanopowder (C,99%,Single Layer)	High Carrier Mobility
NS6130-06-601	Carbon Nanotubes (SWCNT, 99+%, OD: 2-3nm)	High Current Density
NS6130-01-143	Silicon Nanopowder (Si, 98+%, <50 nm,)	Device Fabrication
NS6130-07-713	Si-AL Nanopowder, >99% <80nm	Chemical Sensors

Nano Information & Communication
Memory Storage

Current memory technologies fall into three separate groups: dynamic random access memory (DRAM), which is the cheapest method; static random access memory (SRAM), which is the fastest memory but both DRAM and SRAM require an external power supply to retain data; and flash memory, which is non-volatile it does not need a power supply to retain data, but has slower read-write cycles than DRAM.

Carbon nanotubes tubes made from rolled graphite sheets just one carbon atom thick could provide the answer. If one nanotube sits inside another slightly larger one, the inner tube will 'float' within the outer, responding to electrostatic, van der Waals and capillary forces. Passing power through the nanotubes allows the inner tube to be pushed in and out of the outer tube. This telescoping action can either connect or disconnect the inner tube to an electrode, creating the 'zero' or 'one' states required to store information using binary code. When the power source is switched off, van der Waals force which governs attraction between molecules keeps the Inner tube in contact with the electrode. This makes the memory storage non-volatile, like Flash memory.

Stock Number	Product Description	Application
NS6130-01-108	Gold Nanopowder (Au, 99+%, 50-100nm)	Enhancing Charge
NS6130-01-143	Silicon Nanopowder (Si, 98+%, <50nm)	High Refractive Index
NS6130-01-151	Platinum Nanopowder (Purity: >99.9%, APS: <80nm)	Charge Storage Layers
NS6130-07-713	Si-AL Nanopowder, >99% <80nm	Energy Storage
NS6130-09-906	Fe-Ni Alloy Nanopowder, >99%, <80nm, Fe:Ni/5:5	Magnetic Data Storage
NS6130-06-639	SWCNT COOH Elec , Electrical-grade SWCNTs, >99%, OD: 2-3nm,	Magnetic Data Storage
NS6130-06-698	SWCNT Fluoronated (High Purity, 99%, Dia: <5nm, L: 20-30um)	Magnetic Data Storage
NS6130-03-365	Graphene Multi Layered (4-6 Layer Flakes, >80%, 1um-10um)	Magnetic Data Storage

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Nano Heavy Industry

Aerospace
Nano Structured Coatings
Nano Catalysis

Nano in Smart Structures
Concrete
Coatings
Steel Structure Composite
Fire Protection & Detection

Automobiles
Nanotechnology in Automobiles
Nanotechnology Drive of the future

Nanobased Industrial Technology

NANOSHEL LLC
3422 Old Capitol Trial Suit 1305
Willmington DE - 19808, United States
Phone : +1 302 268 6163
Fax: +1 302 996 5818
E-mail: sales@nanoshel.com
Web : www.nanoshel.com

Intelligent Material Pvt. Ltd.
Plot No. 117, Industrial Area, Ph-2,
Panchkula 134109 Haryana (India)
Phone: +91 9779880077, +91 9569591212
Fax: +91 22 66459880
Email: nanoshel2@gmail.com
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Product Catalogue

New Era of Nano Applications....!

Nanocatalyst: effect of size reduction

Catalytic technologies are critical to present and future energy, chemical process, and environmental industries. Conversion of crude oil, coal and natural gas to fuels and chemical feedstock, production of a variety of petrochemical and chemical products, and emission control of CO, hydrocarbons, and NO, all rely on catalytic technologies. Catalysts are also essential components of electrodes for fuel cells that use either solid oxide ionic or polymeric proton electrolyte.

Drivers for development of advanced catalysts include

- Production of high value products with inexpensive raw materials
- Energy-efficient and environmentally-benign chemical conversion processes
- Increasingly stringent environmental regulations
- Low-cost catalysts such as with reduction or replacement of precious metals

Introducing a catalyst increases the speed of a reaction in one of three ways

- It can lower the activation energy for the reaction
- Act as a facilitator and bring the reactive species together more effectively
- Create a higher yield of one species when two or more products are formed

In era of nanotechnology where size of every object is going to smaller and smaller with their enhanced properties; catalysts of nano size are also used in several chemical processes and beneficial for human being. In this section we are trying to collect all literature data on application of nanocatalyst reported within the last few years.

Product Description	Application
Al2O3 NanoPowder	Water Purification
N-Doped TiO2 & ZrO2	Water Purification
KF/CaO Nanocatalyst	Bio Diesel Production
Platinium Colloidal	Fuel Cells Application
Carbon Nanotubes	Drug Delivery
TiO2 NanoPowder	Photo Catalytic Activity
Nano Aluminium Metal Powder	Solid Rocket Propellants
CdS, CdTe Nanopowder	Thin Film Solar Cell
Nano Sized Palladium Catalysts	West Water Treatments
Carbon nanotubes	Fuel Cells, Molecular Sieves, Double Layer Capacitors Li-ion Secondary Batteries

The aerospace applications for nanotechnology include high strength, low weight composites, improved electronics and displays with low power consumption, variety of physical sensors, multifunctional materials with embedded sensors, large surface area materials and novel filters and membranes for air purification, nanomaterials in tires and brakes and numerous others.

Product Description	Application
Carbon nanotubes, nanofibers	Designer properties, programmable materials
Polymer clay nano composites	High strength, low weight
Polymer cross-linked aerogels	Physical Sensors
Biomimetic hybrids	Reduced life cycle costs

Nano Aerospace
Nanostructured Coatings

Nanoshel nanomaterials that have a great potential in aerospace components such as: New nanoporous filters and sensors for comfort and safety, control of air quality and safety

- Noise reduction via controlled size nanopores
- New catalysts: heterogeneous catalysts use 1-50nm nanoparticles.
- Zeolites and new artificial high-surface area materials may be interesting new catalysts
- Sensors based on nanoparticles able to obtain new selectivities and increased sensibility

NANOSTRUCTURED COATINGS

Currently under development, there are multifunctional nanocoatings for aerospace that can provide corrosion protection using environmentally safe materials; sense corrosion and mechanical damage of aircraft skin; initiate responses to sensed damage either as alarm changes in colour or real selfhealing behaviours; and improve fatigue resistance. For example, CrAlN is a multiphase coating composed of CrN nanocrystalline grains where Al is in solid solution within the grains or in the boundary region as an amorphous mixture of Al-N and Al-O.

Nanostructured SiO2, ZrO2-SiO2, Al2O3-SiO2 ceramic layers obtained both by sol-gel and electrophoretic deposition are alternative for corrosion protection on aluminum alloys. Other functionalities as abrasion resistance are nanocomposite layers composed of conductive polymers and corrosion inhibitors (CeO2, ZrO2, montmorillonite) are being deposited by chemical and electrochemical techniques for corrosion protection.

NANOCOMPOSITES

Nanocomposites based on various metal, ceramic or plastic matrix material strengthened by metal or ceramic nanoparticles or nanoplatelets can improve the strength by 100%. But also layered silicate nanocomposites are finding applications in engine components and fuel storage tanks due to their increased lifetime, enhanced strength and elastic modulus and improved polymer barrier properties.

Polymer-silicate nanocomposites have been an attractive means of improving matrix resins in carbon-fiber-reinforced composites. Organic modification of the silicate aids dispersion into the polymer matrix and provides a strong interaction between the nanoclay and the matrix. The dispersion of the layered silicate clay improves the stability as well as the stiffness, strength and barrier properties of polymers without altering current processing techniques.

Stock Number	Product Description	Application
NS6130-01-142	Silicon Nanopowder (Si, 99+%, <80 nm, Monocrystalline)	Nanostructured Coatings
NS6130-03-301	Al_2O_3 Nanopowder (Al_2O_3, alpha, 99%, <80 nm,)	Nanostructured Coatings
NS6130-03-363	Zirconium Oxide Nanopowder (ZrO_2, 99+%, <80 nm,)	Nanocomposites
NS6130-01-105	Aluminum Nanopowder (Al, 99+%, 100 nm, metal basis)	Nanocomposites

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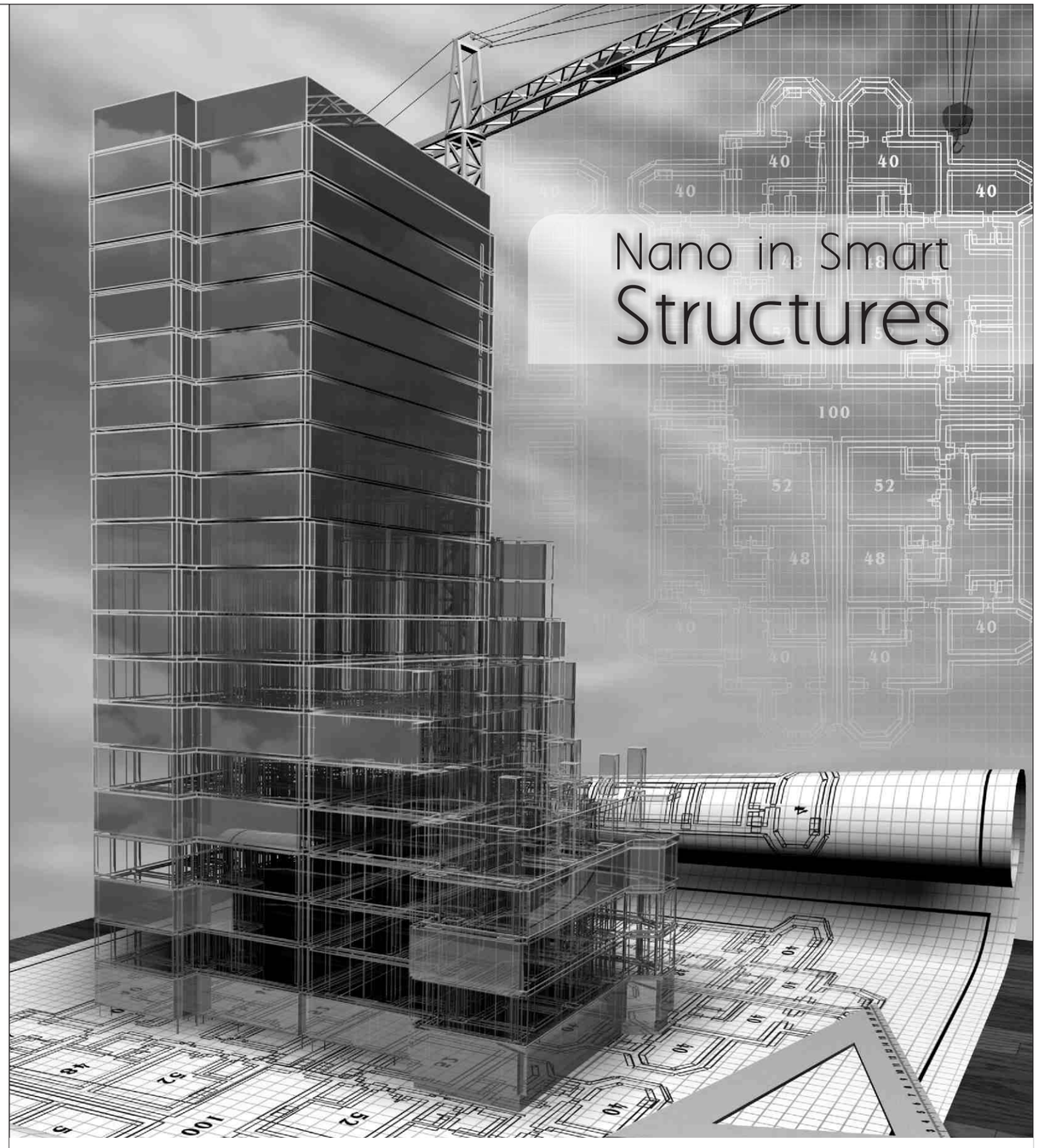

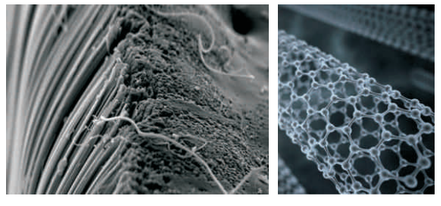

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Nano Smart Structure
Coatings

Materials Modification and Enhancement Towards Energy Efficient and Green Buildings

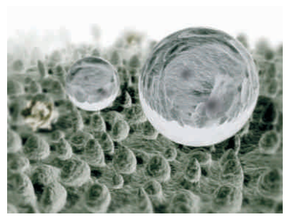
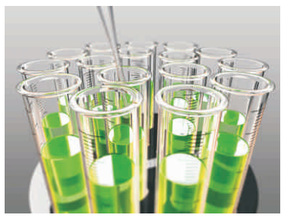
Buildings are responsible for about 90% of the total electricity consumption at end-use level, and account for over 60% of the total Green House Gas (GHG) emission. With increasing concern of the GHG emission arising from electricity consumption and the elevated energy costs, the demand for better thermal insulation in the building enclosures will accelerate.

Nanotechnology can also be used to fabricate materials to trap or re-direct light and heat to desired areas for energy conservation. For instance, nano coatings or treated surfaces can alter the thermal properties of window glasses, as specific nano particles can be used to increase or decrease infrared absorption. Porosity can also be introduced to window coating to lower the thermal conductivity to slow down heat transfer, forming energy efficient glass materials for buildings.

In another project, an inorganic thermal insulation coating material has been developed based on wave reflection theory. Since inorganic materials are used, the risk of emitting harmful organic substances to the environment over time is eliminated. The multi-layered coating material consists of a periodical two-layered structure which acts as a radiant barrier. The thermal insulation can be greatly enhanced again with air-filled glass beads in the coating material. Yet another thermal insulating coating can be formed by adding titanium dioxide (TiO2) nanoparticles into an anchoring polymer matrix with self cleaning property.

With the increasing demand for energy efficient buildings, successful completion of such projects would provide technologies that can be readily commercialized to achieve building construction with green features and good insulation.

Fire protection of structural building materials can be done through insulation schemes using fire resistant steel, fire resistant coatings using ceramic, diluting and endothermic reagents, and intumescent paints. Nano fillers can be used to reduce flammability and improve physical properties.


Stock Number	Product Description	Application
NS6130-03-344	Silicon Oxide Nanopowder (SiO_2,99+%, 20-30 nm)	Lower Thermal Conductivity
NS6130-03-353	Titanium Oxide Nanopowder (TiO_2, anatase/rutile, 99%, 20nm)	Self Cleaning Property

Nano In Smart Structures
Concrete

Areas of applying nanotechnology in construction will be mainly focused on :

- Lighter and stronger structural composites
- Low maintenance coating
- Better proper ties of cementitious materials
- Reducing the thermal transfer rate of fire retardant and insulation
- Construction related nano-sensors.

Concrete is one of the most common and widely used construction materials. Its properties have been well studied at macro or structural level without fully understanding the properties of the cementitious materials at the micro level. The rapid development of new experimental techniques makes it possible to study the properties of cementitious materials at micro/nano-scale. Research has been conducted to study the hydration process, alkali-silicate reaction (ASR), and fly ash reactivity using nanotechnology. The better understanding of the structure and behavior of concrete at micro/nano-scale could help to improve concrete properties and prevent the illness, such as ASR.

Addition of nanoscale materials into cement could improve its performance. Nano- SiO_2 could significantly increase the compressive for concrete, containing large volume fly ash, at early age and improve pore size distribution by filling the pores between large fly ash and cement particles at nanoscale. The dispersion/slurry of amorphous nanosilica is used to improve segregation resistance for self-compacting concrete. It is also been reported that adding small amount of carbon nanotube (1%) by weight could increase both compressive and flexural strength.

Cracking is a major concern for many structures. University of Illinois Urbana-Champaign is working on healing polymers, which include a microencapsulated healing agent and a catalytic chemical trigger (Kuennen, 2004). When the microcapsules are broken by a crack, the healing agent is released into the crack and contact with the catalyst. The polymerization happens and bond the crack faces. The self-healing polymer could be especially applicable to fix the microcracking in bridge piers and columns. But it requires costly epoxy injection at present.

Stock Number	Product Description	Application
NS6130-03-344	Silicon Oxide Nanopowder (SiO_2,99+%, 20-30 nm)	Increase Compressive Strength
NS6130-06-680	Industrial-grade MWNTs (>80%, OD:20-40 nm)	Increase Flexural Strength
NS6130-09-901	Clay Nanopowder , >99%, 80-150nm	Increase Flexural Strength
NS6130-09-920	Kaolite Nano Clay, >99%, <80nm	Increase Flexural Strength
NS6130-09-907	Natural Montmorilonite Modified , >99%, <80nm	Increase Flexural Strength
NS6130-03-394	TiO_2 Degussa, P-25 (TiO_2, anatase/rutile, 99+%, 300-400nm)	Increase Flexural Strength
NS6130-03-385	TiO_2 Nano Tubes (Purity:>99%, Dia:80-100nm)	Increase Flexural Strength

Nano Smart Structures
Fire Protection & Detection

Firefighters work at dangerous disaster sites where their lives are put at risk. For these firefighters, protective clothing can easily be called the most important lifesaver available to them. The fabric of such clothing is very stiff due to the high heat resistance that is demanded.

This makes it uncomfortable and not very functional to wear. We have thus far measured and analyzed the heat resistance, comfort, and functionality of protective clothing, and based on the findings, have proposed standard values for the performance of such clothing in Japan.

In an attempt to raise heat resistance, comfort, and functionality performance, attempts have been made to develop protective clothing using a variety of existing materials, but progression is currently at a dead end. The development of new protective clothing promises to protect firefighters and help them perform firefighting effectively. In an effort to spark a groundbreaking evolution in protective clothing, we are pursuing research in this area using nanotechnology, for example nanomaterials and nanocoatings.

Methods and standards for evaluating the heat resistance, comfort, and functionality demanded for nanotechnology-based protective clothing, and are planning the development of a simulation program that can predict the heat resistance of protective clothing by entering the physical parameters of the fabric from which it is made.

Product Description	Application
Carbon nanotubes	Lightweight bulletproof vests and shirts
Nanofibers	Colour changing property
Nanofibers nano composites	Waterproof and Germ proof
Nanowhiskers	Cleaner kids clothes
Conductive Nano Fiber	Wired and Ready to Wear
Silver Nanopowder	Antibecterial Clothes

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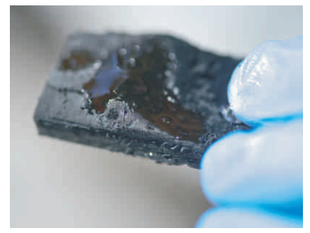
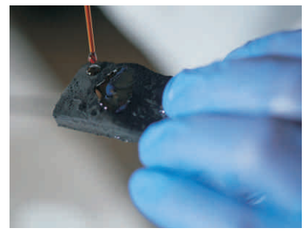
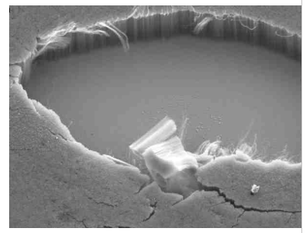
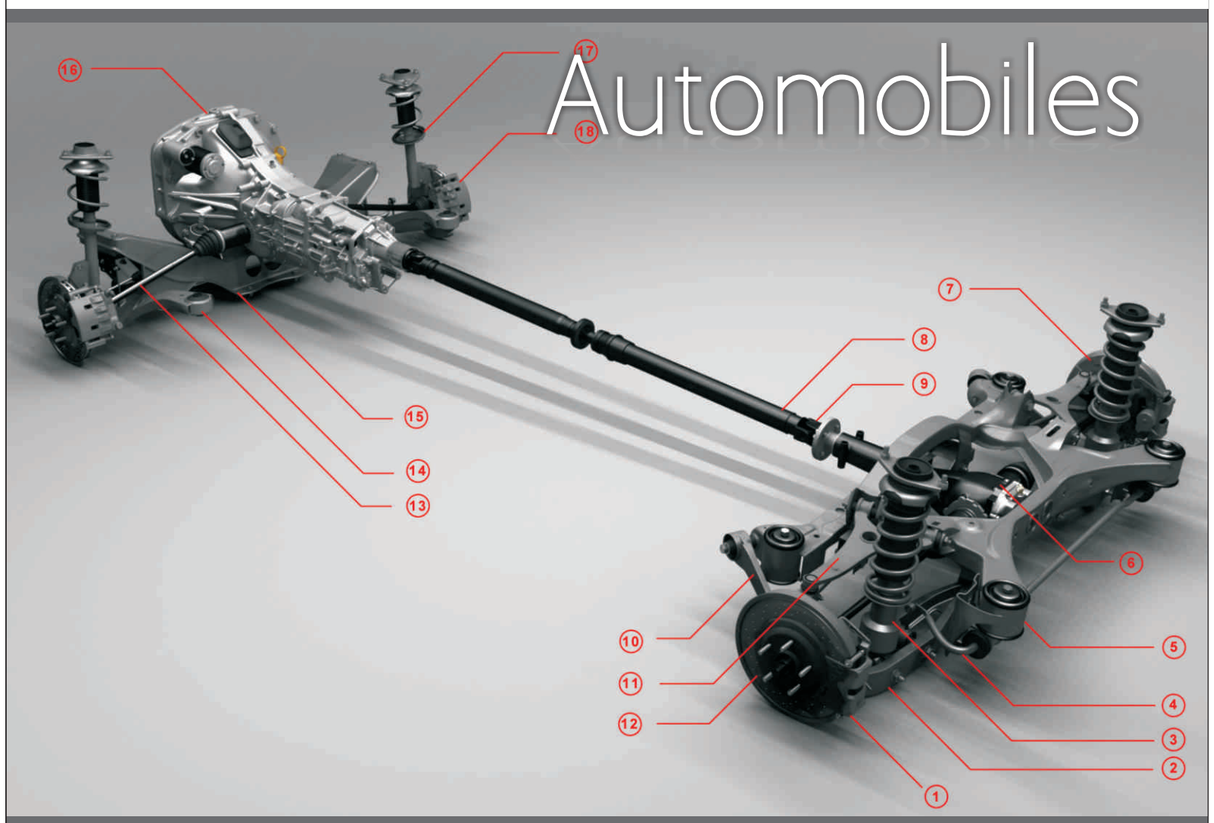
Nano Heavy Industry









Nano Automobiles
Nanotechnologies in Automobiles

The demand of automobiles is increasing rapidly especially in the countries like China, India, Brazil and Korea. The rising economies of these countries will further increase the demand of automobiles. In order to achieve safety, comfort and environment friendliness, automobile companies are investing heavily in research and development. In this context, nanotechnologies are likely to play an important role. Nanotechnology is opening new doors for innovative products and imaginative applications in automobile sector.

Nanotechnology for Car Body

Nano Steel - A high strength yet light weight material for car body can be produced by using Carbon Nanotubes.The small size of only five to ten nanometer of carbon nitride is responsible for this outstanding properties.

Corrosion Protection - Widely used Chrome III (Cr3+) does not offer long term protection. By the use of nanotechnologies it has been made possible to enhance protection by the use of SiO2 nano particles in the electrolyte. The passivation achieved through galvanization processes consists of a Cr3+ enriched layer and a layer containing SiO2 nano particles in a Cr3+ matrix.

Nanotechnology for Chassis and Tyres

Soot and Silica are the most important chemical ingredients used for reinforcing in tyres. By using nano structured soot as filler in tyres, prolonged durability and higher fuel efficiency can be achieved. These nano structured soot particles have a coarser surface than those that have been used till date. Nano particles result in increased surface energy thereby increasing the interaction with the natural rubber molecules.

Nanotechnology for Shell of the Car

Scratch Resistance - Nanotechnology holds great promise in reducing the weight of the glass by the substitution of mineral glass by polymer glass. In order to make polymer glass scratch and impact resistant , it is coated with paints having extremely hard aluminum oxide nano particles placed in the substrate matrix during the hardening process resulting in high abrasive resistance with increased impact strength.

Ultra Thin Layers for Mirrors and Reflectors - Fluor-organic material which exhibits both hydrophobic and oelophobic qualities when segregated on a work piece. This layer with a thickness of 5 to 10 nanometers creates a super smooth surface and has ease of cleaning water drops, oil, dust, dirt etc. It offers good dynamic friction properties and thus longer durability of the layer.

Nanotechnology for Engine and Transmission System

Reduction in Friction amongst Moving Parts - Coating materials with imbedded nano crystals with a size from 60 nm to 130 nm on the basis of iron carbide and boride result in extremely high surfaces with low friction properties. Nano structure ceramics (Zircon, Alumina) or nano reinforced ceramics (Alumina + Silicon Nitride) are being extensively studied for engine jacketing. Nano crystalline ceramics like Si3N4 or SiC are also being used in ball bearings and valve springs.

Improving Fuel Injection - Nanocrystalline piezoelectric materials are used (Lead-Zirkone Titanate) in injectors regulating the distance which is in nanometer range.

Nano Automobiles
Nanotechnology: Drive of the future

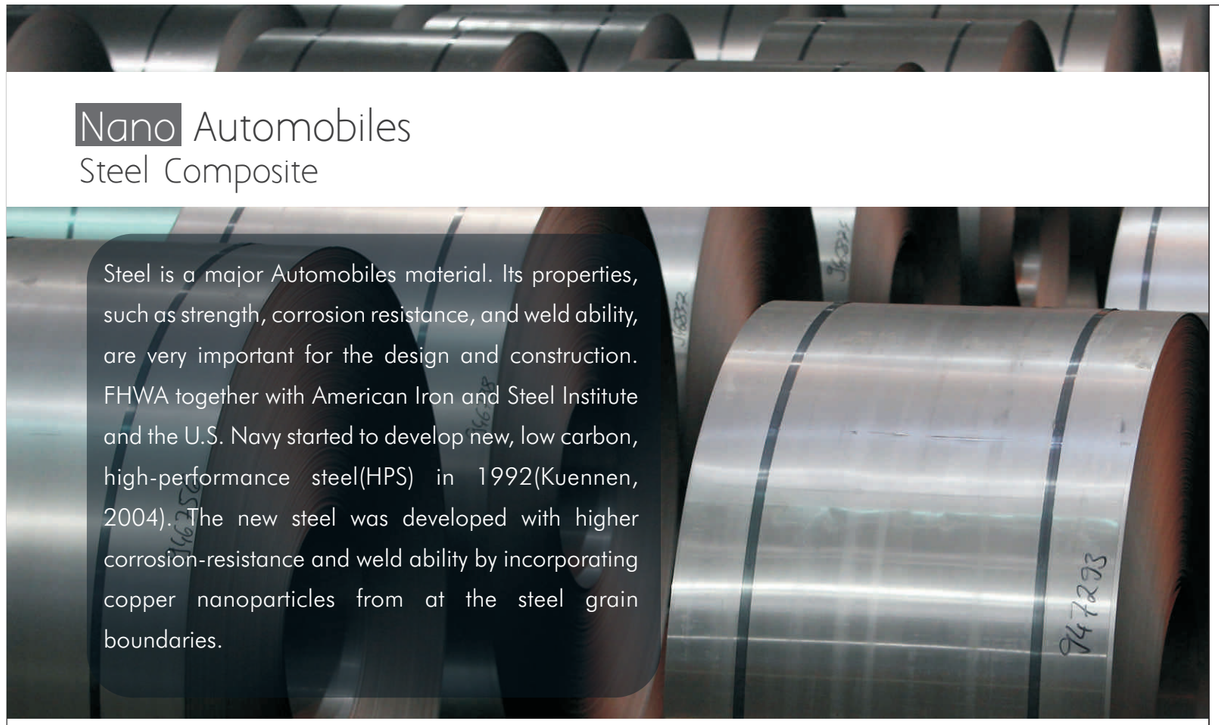
Chassis. In the same manner that the engine and its parts were made lighter, the same benefit happened in the case of the chassis. Aside from being lighter, chassis and engines were also made more durable, making them withstand daily workload on the road.

Engine and transmission systems. In contemporary cars, a large share of the vehicle's weight is due to the weight of the engine and the transmission system of the vehicle. As a result, cars are fuel-hungry because of the need to push forward such a heavy machine. Nonetheless, with the advent of alloys, engines were made lighter somewhat but not sufficient to make them fuel-efficient. The answer came with the arrival of nanotechnology. With nanotechnology, engines and parts were made a lot lighter, thus eliminating the need to consume more fuel just to power the vehicle forward.

One of the most advanced examples of nanotechnology in cars involves the production of paint that is constituted in microvolumes. The idea is to create a surface that automatically heals itself whenever it is scratched or tainted with some foreign mark. This procedure allows for the paint to release nano paint particles that automatically spreads to cover up the scratched area. It works instantly you'll hardy notice the surface was scratched at some point.

Another of the advanced applications of nanotechnology for cars involves the production of mirrors and side panels that are made out of nano particles. Being so, they filter the rays of the sun, smoke, and other pollutants in the atmosphere. The same technology allows radio and phone signals as well as sound waves to freely enter the cars so that the occupants of the vehicle will not be made oblivious to the world outside. This is beneficial for those who have some form of hearing defects; even with all the windows closed, you may still be able to hear the honking of the horn of the next car.

Stock Number	Product Description	Application
NS6130-06-680	Industrial-grade MWNTs (>80%, OD:20-40 nm)	Increase Flexural Strength
NS6130-03-640	Carbon Nanotubes (MWCNT, OD: 20-30nm, 99%)	Increases Conductivity
NS6130-01-121	Carbon Nanofibers (Purity: >96%, OD: 500nm)	Strength & Flexibility
NS6130-01-127	Copper Nanopowder (Cu,99%, 100-250 nm, metal basis)	Automatically Healing
NS6130-06-637	Electrical-grade SWCNTs (>,99%,OD:2-3nm)	Filtration at nano level



Nano Automobiles
Steel Composite

Steel is a major Automobiles material. Its properties, such as strength, corrosion resistance, and weld ability, are very important for the design and construction. FHWA together with American Iron and Steel Institute and the U.S. Navy started to develop new, low carbon, high-performance steel(HPS) in 1992(Kuennen, 2004). The new steel was developed with higher corrosion-resistance and weld ability by incorporating copper nanoparticles from at the steel grain boundaries.

Sandvik Nanoflex TM is new stainless steel with ultra-high strength, good formability, and a good surface finish developed by Sandvik Nanoflex Materials Technology. Due to its high performance, Sandvik Nanoflex TM is suitable for application where requires lightweight and rigid designs. For certain applications, the components could be even thinner and lighter than that made from aluminium and titanium due to its ultra-high strength and modulus of elasticity. Its good corrosion and wear resistance can keep life-cycle costs low. Attractive or wear resistant surfaces can be achieved by various treatments (Sandvik Nanoflex Materials Technology).

MMFX2 is nanostructure-modified steel, produced by MMFX Steel Corp. Copared with the conventional steel, it has a fundamentally different microstructure- a laminated lath structure resembling “plywood”. This unique structure provides MMFX2 steel with amazing strength (three times stronger), ductility, toughness, and corrosion resistance. Due to the high cost, the stainless steel reinforcement in concrete structure is limited in high risk environments. The MMFX2 steel could be an alternative because it has the similar corrosion resistance to that of stainless steel, but at a much lower cost.

Stock Number	Product Description	Application
NS6130-06-680	Industrial-grade MWNTs (>80%, OD:20-40 nm)	Increase Flexural Strength
NS6130-03-640	Carbon Nanotubes (MWCNT, OD: 20-30nm, 99%)	Increases Rate of Energy Trf
NS6130-01-121	Carbon Nanofibers, Purity: >96%, OD: 500nm (MW	Increases Rate of Energy Trf
NS6130-01-127	Copper Nanopowder (Cu,99%, 100-250 nm, metal basis)	Increases Rate of Energy Trf

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Nano ConsuMer Goods

Household | Optics | Textiles | Cosmetics | Agriculture | Sports | Nano Foods

Nanobased Consumer Applications

Nano Consumer Goods
Houshold Products

Nanotechnology is already being used in various cleaning products to make your life easier and have less environmental impact.

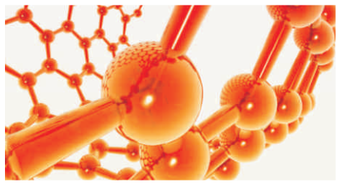
Companies are looking into using nanoparticles in soap that make it work better while producing less environmentally harmful byproducts. For example, EnviroSan Products offers a product called Solution 2000, and Nano Green Sciences produces a cleaning product called Nano Green. Both products contain organic nanoparticles, called micelles, which range in size from 1 to 4 nanometers in diameter. Several micelles bond to grease molecules, tying up all the atoms in the grease molecules that are attached to a surface, such as your countertop. After these micelles latch on, you can easily wipe away the grease molecules.

Some companies, such as AltimateEnviroCare Services and EcoActive Surfaces, are using titanium oxide nanoparticles as part of a film that uses the energy in light to kill bacteria on surfaces. Titanium oxide nanoparticles are called photocatalysts because of their capability to use energy in light to start the chemical reaction that kills the bacteria.

OxiTitan is a spray that coats a surface with zinc nanoparticles and titanium dioxide nanocrystals. This coating reacts with water in the air to break water down into oxygen and hydroxide ions. These ions then react with bacteria, viruses, volatile organic compounds, and mold, turning these organic molecules into carbon dioxide and less harmful organic molecules.

Some companies are using antibacterial materials that contain silver nanoparticles. Daido Special Steel Corporation has developed at spray called HGT Nano Silver Photocatalyst that is a combination of silver nanoparticles and titanium dioxide nanoparticles. This product performs when light is available, with the silver nanoparticles enhancing the photocatalytic performance of the titanium nanoparticles.

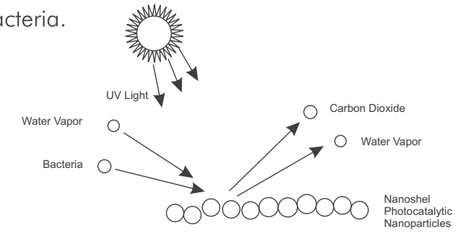
However, because silver nanoparticles kill bacteria even when light is not available, the treated surface will have antibacterial properties even in the dark. At this time, the product is available only in Japan.



A micelle Nanoparticles is an aggregate of surfactant molecules dispersed in a liquid colloid.

APS : 1-4nm

Photocatalytic nanoparticles breaking down bacteria.



Photocatalytic nanoparticles breaking down bacteria.

Stock Number	Product Description	Application
NS6130-03-394	TiO_2 Degussa, P-25 (TiO_2, anatase/rutile, 99+%, 300-400nm)	Photocatalytic Nanoparticles
NS6130-01-101	Silver Nanopowder (Ag, 99%, 80-100nm)	Anti Bacterial
NS6130-03-362	Zinc Oxide Nanopowder (ZnO, 99+%, 10-30 nm)	Create Micelles Bond

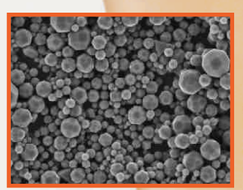
For questions, product data, or new product suggestions, please contact NANOSHEL at info@nanoshel.com

Nano Consumer Goods
Cosmetics & Self Care

Sunscreen contains titanium dioxide (TiO_2) and zinc oxide (ZnO) which block out ultraviolet light that comes from the sun. As we know, the whiter the sunscreen means the stronger it is at blocking light. But by breaking down the TiO_2 and ZnO to nano sized particles, the cream becomes transparent when applied to the skin allowing you to get the same amount of protection for your skin without being covered in white cream. This form of nanotechnology is also used in lotions and moisturisers.

Another common use of nanotech is using silver nanoparticles in personal care products. The silver nanoparticles are very effective at breaking down and killing bacteria. The particles are used throughout the world to maintain cleanliness in body care products such as hair brushes, tooth brushes, electric razors, hair dryers, hearing aid, foot massagers and make up instruments.

Stock Number	Product Description	Application
NS6130-03-353	Titanium Oxide Nanopowder (TiO_2, rutile, 99.9%, 30nm)	Block UV Rays
NS6130-03-361	Zinc Oxide Nanopowder (ZnO, 99%, 35-45nm)	Block UV Rays
NS6130-01-103	Silver Nanopowder (Ag, 99%, 30-50nm)	Anti Bacteria



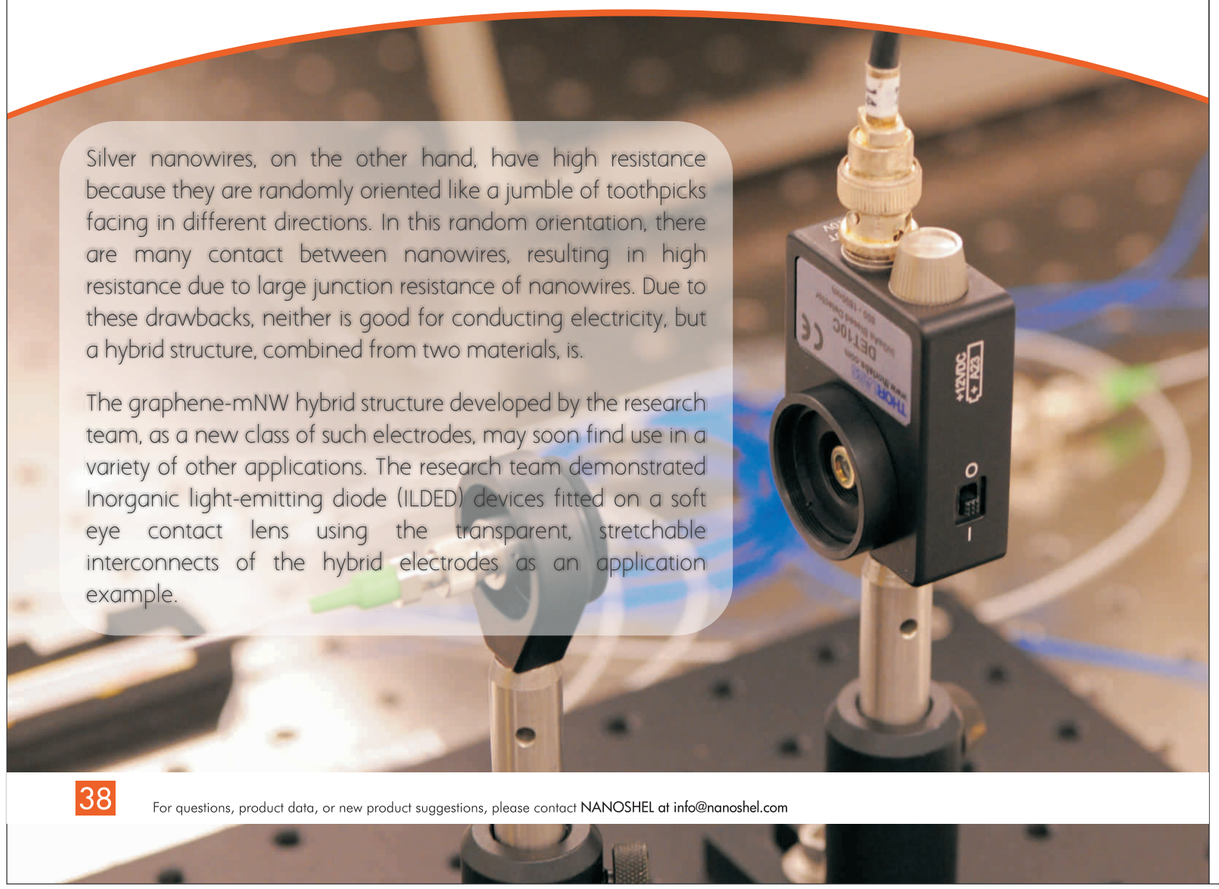
Nano Consumer Goods
Optics

Stretchable, transparent graphene-metal nanowire electrode: Eye contact lenses, picture-taking and scanning, possibly, a wearable black box

Transparent electrodes are in and of themselves nothing all that new - they have been widely used in things like touch screens, flat-screen TVs, solar cells and light-emitting devices. Currently transparent electrodes are commonly made from a material known as indium tin oxide(ITO). Although it suffices for its job, it's brittle, cracking and losing functionality if flexed. It also degrades over time, and is somewhat expensive due to the limited quantities of indium metal.

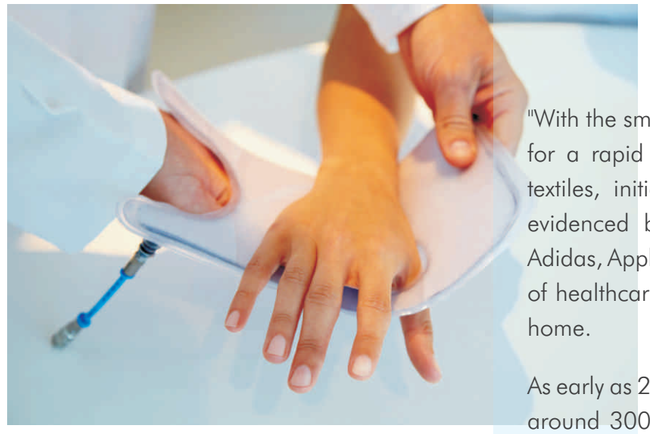
As an alternative, the networks of randomly distributed mNWs have been considered as promising candidates for next-generation transparent electrodes, due to their low-cost, high-speed fabrication of transparent electrodes.

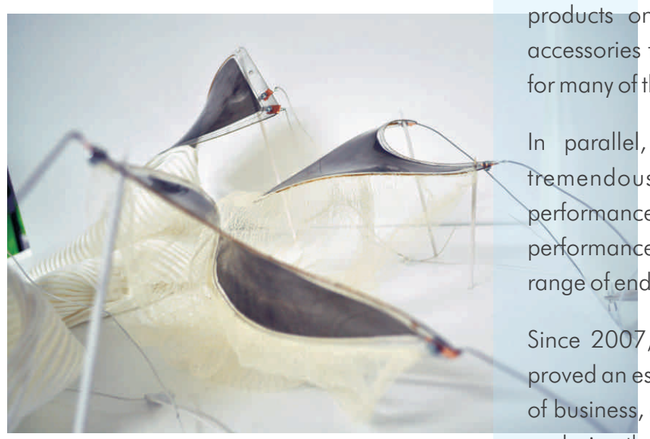
Graphene is also well known as good a candidate for transparent electrode because of their unique electrical properties and high mechanical flexibility. However, scalable graphene synthesis methods for commercialization produces lower quality graphene with individual segments called grains which increases the electrical resistance at boundaries between these grains.

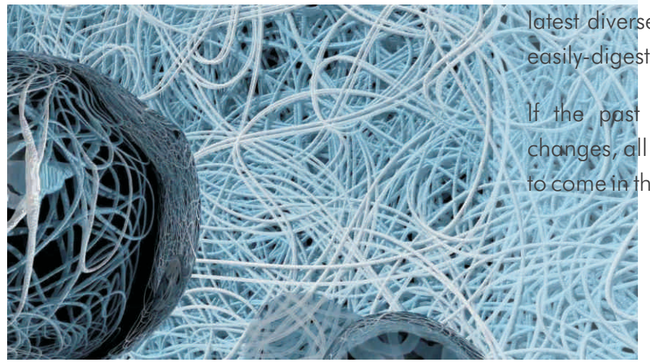


Silver nanowires, on the other hand, have high resistance because they are randomly oriented like a jumble of toothpicks facing in different directions. In this random orientation, there are many contact between nanowires, resulting in high resistance due to large junction resistance of nanowires. Due to these drawbacks, neither is good for conducting electricity, but a hybrid structure, combined from two materials, is.

The graphene-mNW hybrid structure developed by the research team, as a new class of such electrodes, may soon find use in a variety of other applications. The research team demonstrated Inorganic light-emitting diode (ILDED) devices fitted on a soft eye contact lens using the transparent, stretchable interconnects of the hybrid electrodes as an application example.







Nano Consumer Goods
Textiles

"With the smart phone now ubiquitous, the scene is set for a rapid escalation of intelligent clothing and e-textiles, initially in the sports monitoring field as is evidenced by the latest products from brands like Adidas, Apple and Nikeand in the next wave in the fields of healthcare, lifestyle, transportation, energy and the home.

As early as 2016, for example, there are expected to be around 300 million body-worn wireless sensor-based products on the market, making the transfer from accessories to integrated textile components inevitable for many of them.

In parallel, nanotechnology has been making a tremendous impact on the functionality and performance of not only textiles, but virtually all performance materials, and across an equally diverse range of end-markets.

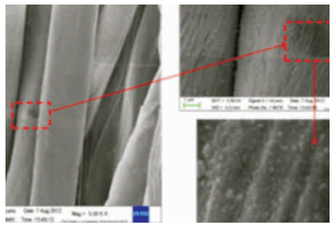
Since 2007, Smart Textiles and Nanotechnology has proved an essential guide to these fascinating new fields of business, charting all the exciting developments and exploring their implications, while bringing together the latest diverse company and product information in an easily-digested format.

If the past five years has seen some unparalleled changes, all the indications are that there is much more to come in the next five.

Stock Number	Product Description	Application
NS6130-03-353	Titanium Oxide Nanopowder (TiO_2, anatase/rutile, 99%, 20nm)	Block UV Rays
NS6130-03-361	Zinc Oxide Nanopowder (ZnO, 99%, 35-45nm)	Block UV Rays
NS6130-01-103	Silver Nanopowder (Ag, 99%, 30-50nm)	Anti Bacterial

Nano Consumer Goods
Smart Conductive Textiles

Researchers has developed a technique for chemically bonding a nano-silver layer onto fibres in a textile. The step change advantage of our method is that the conductive path is applied by an additive method and can be patterned to form circuits. The silver is bound around individual fibres in each thread giving 100% coverage (Fig 1), with good adhesion and flexibility. Excellent resistivity of

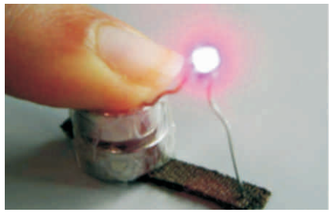


the textile has been achieved, <0.2Ω/sq. The nanosilver coated fabric can be used in a wide range of applications such as wound dressings, hygienic clothing and medical applications where the presence of bacteria is hazardous. For example, it can be used for the fabrication of face masks, surgical gloves and military uniforms where the infection of the wound can have severe effect. The high flexibility of fabric textiles allows them to be employed in the health, leisure and sports industries.

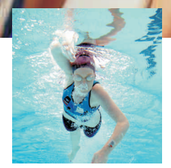
Since the conductive pattern is incorporated within the textile, it ensures that sensors are repeatedly positioned in the same location on the body. This will lead to improved accuracy of the sensor by preventing sensor misplacement.

It also adds a negligible weight and thickness to the clothes and multiple electronic circuitry patterns can be placed on a garment in a single setup. As an example, wireless wearable sensors for home monitoring of physiological data of a heart could, for instance, overcome shortcomings of currently available technology such as "Holter monitoring" and significantly improve the diagnosis and treatment of cardiovascular diseases.

In general, there is an increasing demand for wearable electronics from industries such as sport and fitness, consumer electronics, medical and healthcare, and defence applications. Manufacturing flexible and complex electronic circuitry patterns could be successfully solved by the use of this method and can be applied in the future design of intelligent clothing. This additive process permits complex circuit traces to be added to fabrics for a wide range of uses. Devices or sensors can be positioned by directly building them into fabric, which offers a novel approach for providing information routing within fabric, which is a major hurdle in electronic textile development.

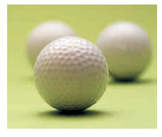


Stock Number	Product Description	Application
NS6130-01-101	Silver Nanopowder (Ag, 99%, 80-100nm)	
NS6130-01-102	Silver Nanopowder (Ag, 99%, 50-80nm)	
NS6130-01-103	Silver Nanopowder (Ag, 99%, 30-50nm)	



Swim suits that act like a coating far slicker than Teflon. The water bounce of it and swimmers can literally skim across the pool.
NS6130-09-901 Clay Nanopowder (>99+%, 80-150 nm)

Improved tennis balls that bounce longer due to an engineered nano-composite gas barrier.
NS6130-09-901 Clay Nanopowder (>99+%, 80-150 nm)



Golf ball that spin more accurately due to the shifting of weight at an atomic scale inside the ball.
NS6130-09-901 Clay Nanopowder (>99+%, 80-150 nm)

Stronger and lighter snow ski. They are now five- times stiffer because of nanotubes.
NS6130-06-640 Carbon Nanotubes (>99+%, 20-30 nm)

Lighter bikes and faster racing with bicycle handles composed of ultra-light carbon nanotubes
NS6130-06-640 Carbon Nanotubes (>99+%, 20-30 nm)

Shoe Sole won't chip or crack thanks to an extra-tough nanotech coating called fullerenes
NS6130-06-640 Carbon Nanotubes (>99+%, 20-30 nm)

Nano Consumer Goods

Nano Foods

Not much research is being put into the use of nanotechnology in food but there is much potential in this branch of the science. There is a lot of general speculation about how nanotechnology can be used in our food products from ways to add different flavours, to more futuristic ideas like developing foods that can change in response to your nutritional needs or taste preferences.

On the Project on Emerging Nanotechnologies list of the 609 known nano-products there are only three foods; a brand of canola cooking oil called Canola Active Oil, a tea called Nanotea and a chocolate diet shake called Nanoceuticals Slim Shake Chocolate.The company producing the canola oil, Shemen Industries of Israel, claims it contains preservatives called "nanodrops" which carry vitamins and minerals throughout the digestive system. The maker of the milkshake, RBC Life Sciences Inc of the USA, uses "nanoclusters" to enhance the taste and health benefits found in cocoa without the added sugar.

Clay nanocomposites are being used to provide an impermeable barrier to gasses such as oxygen or carbon dioxide in lightweight bottles, cartons and packaging films.

NS6130-09-901	Clay Nanopowder (>99+%, 80-150 nm)	Improve Barrier Properties

Storage bins are being produced with silver nanoparticles embedded in the plastic. The silver nanoparticles kill bacteria from any material that was previously stored in the bins, minimizing health risks from harmful bacteria.

NS6130-01-101	Silver Nanopowder (Ag, 99%, 80-100 nm, metal basis)	Kill Bacteria

Researchers are using silicate nanoparticles to provide a barrier to gasses (for example oxygen), or moisture in a plastic film used for packaging. This could reduce the possibly of food spoiling or drying out.

NS6130-03-344	Silicon Oxide Nanopowder (SiO_2, 99+%, 20-30 nm)	Barrier to gasses

Zinc oxide nanoparticles can be incorporated into plastic packaging to block UV rays and provide anti bacterial protection, while improving the strength and stability of the plastic film.

NS6130-03-361	Zinc Oxide Nanopowder (ZnO, 99+%, 35-45 nm)	Improve Strength & Stability

Nanosensors are being developed that can detect bacteria and other contaminates, such as salmonella, at a packaging plant. This will allow for frequent testing at a much lower cost than sending samples to a lab for analysis. This point-of-packaging testing, if conducted properly, has the potential to dramatically reduce the chance of contaminated food reaching grocery store shelves.

NS6130-03-352	Titanium Oxide Nanopowder (TiO_2,99+%, 30 nm)	Nanosensors

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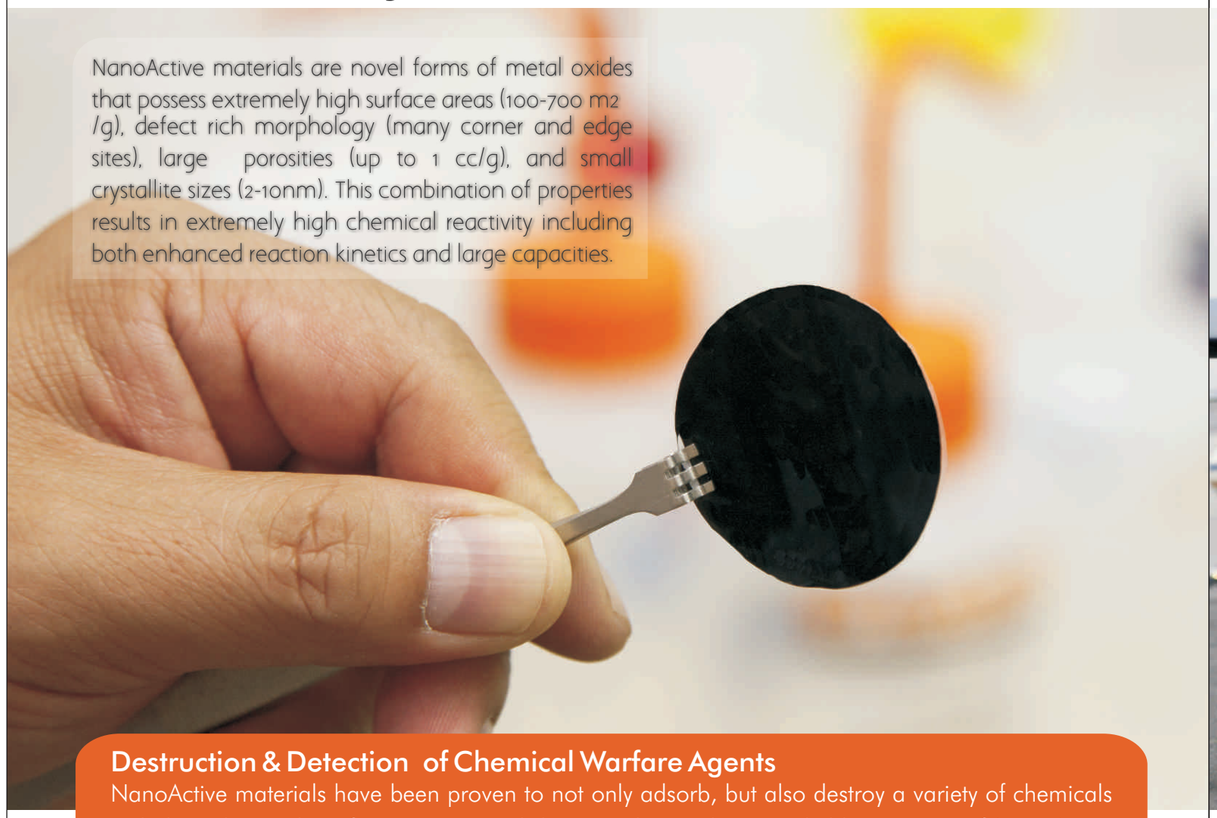
Nano Defense & Security

Chemical Warfare Agents | Tag & Track Quarry Using Nanoparticles | Sensors for Warfare Agents

Nanobased Consumer Applications

Nano Defense & Security
Chemical Warfare Agents



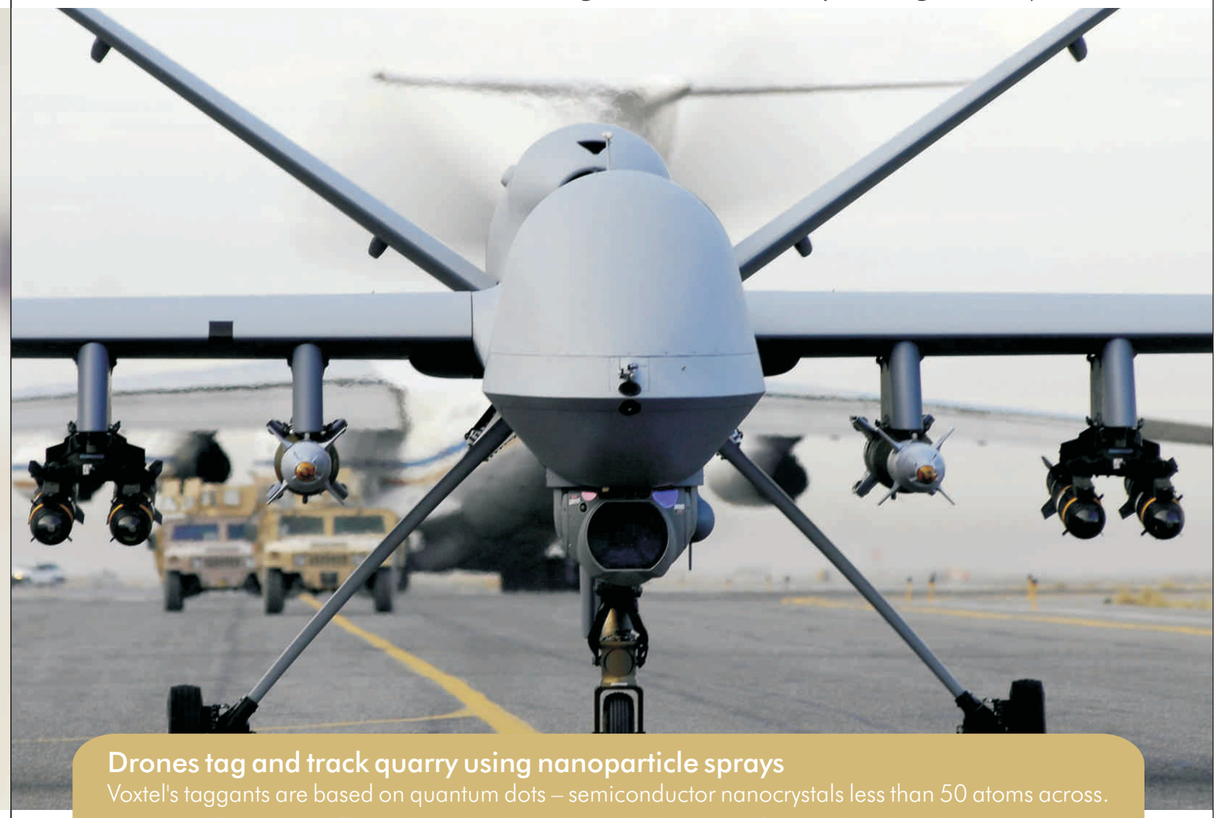
NanoActive materials are novel forms of metal oxides that possess extremely high surface areas (100-700 m2 /g), defect rich morphology (many corner and edge sites), large porosities (up to 1 cc/g), and small crystallite sizes (2-10nm). This combination of properties results in extremely high chemical reactivity including both enhanced reaction kinetics and large capacities.

Destruction & Detection of Chemical Warfare Agents

NanoActive materials have been proven to not only adsorb, but also destroy a variety of chemicals including chemical warfare agents and their simulants. The remarkable reactivity of NanoActive materials towards nerve and blistering agents and destruction below quantifiable levels, has been proven by independent testing at Battelle Memorial Institute and Edgewood Chemical and Biological Center (ECBC). Nanoshel has developed a series of reactive nanoparticles (NanoActive materials) with remarkable properties that can be applied to the U.S. defense arsenal against chemical and/or biological attack. They are based on nanocrystalline metal oxides, such as MgO, TiO2, and Al2 O3, and have been shown to be effective against a broad range of chemical agents at both ambient and high temperatures. Reactive nanoparticles, produced by Nanoshel, are non-flammable, non-toxic, and have a long storage life, are extremely light, and easy to disperse.

Stock Number	Product Description	Application
NS6130-03-303	Aluminum Oxide Nanopowder (Al_2O_3, gamma, 99%, 20nm)	NanoActive materials
NS6130-03-329	Magnesum Oxide Nanopowder (MgO, 99.9%, 60nm)	NanoActive materials
NS6130-03-355	Titanium Oxide Nanopowder(TiO_2, rutile, 92%, 30nm)	NanoActive materials

Nano Defense & Security
Tag & Track Quarry Using Nanoparticles



Drones tag and track quarry using nanoparticle sprays

Voxtel's taggants are based on quantum dots – semiconductor nanocrystals less than 50 atoms across. Because of quantum effects, they absorb and emit light at specific wavelengths. The company has demonstrated a taggant powder that, when illuminated with an invisible ultraviolet laser, can be detected by infrared cameras 2 kilometres away. The powder is delivered as an aerosol that clings to metal, glass and cloth, and batches can be engineered to have distinct spectral signatures. The nanocrystals would be sprayed by a hand-launched drone such as the Raven (pictured). With a wingspan of less than 1.5 metres, it is quiet and has a range of several kilometres. A larger Predator

Stock Number	Product Description	Application
NS6130-02-255	Cadmium Sulphide Nanopowder (CdS, 99%, <50nm)	Semiconductor Nanocrystals
NS6130-02-244	Cadmium Telluride Nanopowder (CdTe, 99%, <50nm)	Semiconductor Nanocrystals
NS6130-02-288	Zinc Sulphide Nanopowder (ZnS, 99%, 30-50nm)	Semiconductor Nanocrystals
NS6130-01-143	Silicon Nanopowder (Si, 98%, <50nm)	Semiconductor Nanocrystals

Nano Defense & Security
Sensors for Warfare Agents

Nanosensor is a new technology of highly integrating between nanotechnology and chemical sensors. For the advantage of good stability, high sensitivity, strong anti-interference and so on, it has good application foreground in the latest filed of gaseous sample detection. In this work, a novel analytical system based on nanosensor array and probabilistic neural network (PNN) was developed to detect chemical warfare agents such as sarin and mustard gas. The array consisted of four quartz crystal microbalance with a fundamental frequency at 10MHz.

To improve the selectivity and sensitivity, four nano-membrane materials such as nano-zeolite modified with copper ion (CuZSM-5), modified carbon nano-tubes (CNT), hydrogen bond acidic fluorinated polymethyldrosiloxane (mTFPS) and polyepichloro-hydrin (PECH) were synthesized and selected as the Sensitive membrane material of chemical warfare agents. Then, a nanosensor array with these nano-film materials was developed. Combined with pattern recognition methods, a qualitative and quantitative identifying mode has been set up. The signals obtained from the array were analyzed with PNN to identify the toxic gases. The success rate of identification was 96.15%. The study integrate a variety of modern high-tech, which has novel methods and a high level of technology, an independent innovation research has been made for China's anti-chemical warfare detector technology, opening up a new generation of chemical detectors and equipment developed in new field.

Stock Number	Product Description	Application
NS6130-01-127	Copper Nanopowder (Cu, 99%, 100-250nm)	Sensitive Membrane Material
NS6130-06-601	Carbon Nanotubes (SWCNT, 99%, OD 2-3nm)	Sensitive Membrane Material
NS6130-09-905	Zeolite Nanopowder (99%, <80nm)	Sensitive Membrane Material

For questions, product data, or new product suggestions, please contact NANOSHEL at info@nanoshel.com

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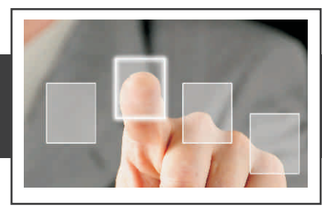
Strategic Innovative Nano Technologies

- Shape Memory Polymer
- Shape Memory Polymer Composite
- Cooper & Nickel Foam
- Nanoshel Conductive Nanotubes (CALIB)
- Pyrolytic Graphite
- Nanoshel Monocrystalline Silicon Wafers
- Sputtering Targets
- Metal Crucibles
- Superhydrophobic Surfaces
- Nanoclays for Nanocomposite
- Nanocomposite
- Nano Filtering System
- Customized Nano Lubricants
- White Polymer Light Emitting Diodes
- Smart Nano Material in Construction Industry
- Thermal Interface Material
- Electron Microscope Metal Grids
- Silver Coated Microspheres - EMI Shielding
- Aluminium Paste
- Nano Solar Cell With Carbon Nano Tubes
- Nanotechnology Solution Abrasive Erosion



Nanobased Innovations

NANOSHEL LLC
3422 Old Capitol Trial Suit 1305
Willmington DE - 19808, United States
Phone : +1 302 268 6163
Fax: +1 302 996 5818
E-mail: sales@nanoshel.com
Web : www.nanoshel.com

Intelligent Material Pvt. Ltd.
Plot No. 117, Industrial Area, Ph-2,
Panchkula 134109 Haryana (India)
Phone: +91 9779880077, +91 9569591212
Fax: +91 22 66459880
Email: nanoshel2@gmail.com
Web : www.nanoshel.in

NANOSHEL®
Creating Miracles in Black

Product Catalogue

New Era of Nano Applications....!

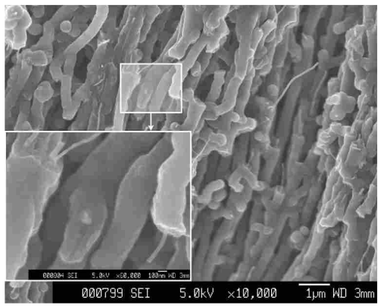
Nano Innovative Materials
Shape Memory Polymer

Shape memory polymers are polymers whose qualities have been altered to give them dynamic shape "memory" properties. Using thermal stimuli, shape memory polymers can exhibit a radical change from a rigid polymer to a very elastic state, then back to a rigid state again. In its elastic state, it will recover its "memory" shape if left unrestrained. However, while pliable it can be stretched, folded, or otherwise conformed to other shapes, tolerating up to 200% elongation.

Activation methods for thermally responsive SMP

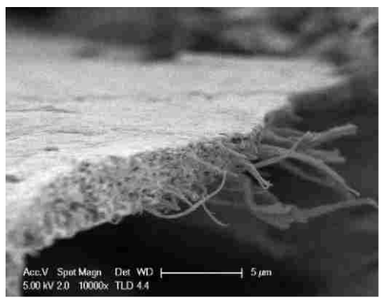
- Resistive heating
- Embedded heaters (for example, stretchy heaters, nichrome wires)
- Contact heating (MRE heaters)
- Induction heating
- Dielectic heating
- Microwave heating
- Infrared radiant heating

Some of these methods may be enabled by fillers such as: conductive fillers, CNT, CNF, iron and ferrite.



Benefits

- Toughness
- Unique shape memory properties
- Recovery to memorized shape after repeated deformation
- Ability to change from a rigid polymer to rubbery elastomer
- Over 95% (one-part resin) and 100% (two-part resin) elongation possib in elastic state
- Low viscosity for easy processing (RTM or VARTM) (two-part resin)
- Open-mold curable
- Aesthetic clarity
- Machinability once cured



Applications

- Customized, reusable molds
- Deployable mechanisms and structures
- Adjustable furniture

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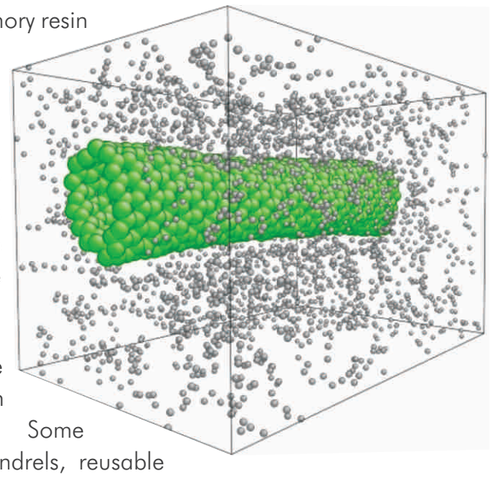
Nano Innovative Materials
Shape Memory Polymer Composite



SMP composites capitalize on the ability of the shape memory resin to quickly soften and harden repeatedly. Because of this property, the composites can be temporarily softened, reshaped, and rapidly hardened to function as structures in a variety of configurations. They can be fabricated with nearly any fiber type, and creative reinforcements allow dramatic shape changes in functional structures. SMP is also machinable. Some possible applications include rapid manufacturing, dynamic structures, composite patching, and adaptable reinforcement.

SMP currently functions on thermal activation customizable from –30°C to 260°C (–20°F to 500°F). Extremely high temperatures and cryogenic ranges may be possible. Some examples of applications include custom reusable mandrels, reusable molds, replica optics, and deployment mechanisms for outer space.

Applications

- Customized containers, adju shipping and packaging
- Actuators
- Sensors
- Space-qualifiable applicatic
- Removable mandrels
- Automotive components

There are many activatio methods for thermally responsive SMP

- Resistive heating
- Embedded heaters (for exam stretchy heaters, nichrome w
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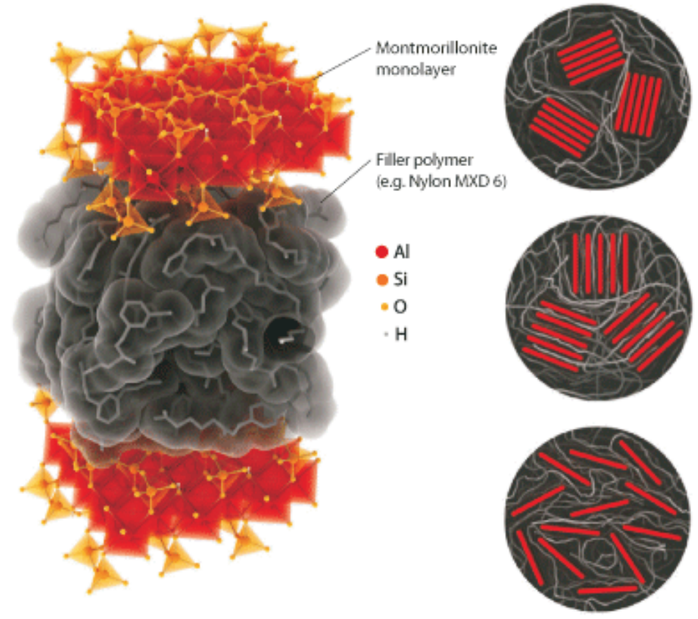
- Dielectic heating
- Microwave heating
- Infrared radiant heating



Stock Number	Product Description	Application
NS6130-09-910	Shape Memory Polymer Pellet - PMM (Injection Extrusion)	Polymer Composite
NS6130-09-911	Shape Memory Polymer Resin & Hardner - PMP (Potting)	Polymer Composite

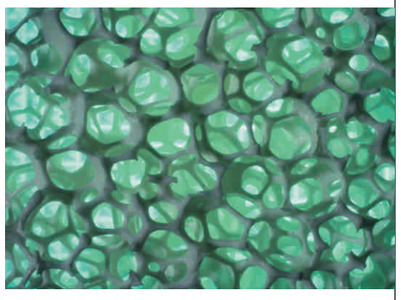
Nano Innovative Materials
Copper & Nickel Foam

There are two distinct types of metal foams: open-cell and closed-cell structures. The key difference between the two structures is that open-cell foams are permeable and will allow fluids to pass through the foam whereas closed-cell foams are impermeable.

One of the key differences of microstructure is that the lace microstructure provides a greater surface area than the one found in sintered copper powder. The lace microstructure also has a significant impact on the flow of liquid through the foam (increased permeability). The distinctive microstructure ofmetallic foams has up to 100 times more specific surface area than competing manufacturers' foams. This particular microstructure also permits capillarity properties that are unmatched in the market. Capillarity is crucial in numerous wicking applications like heat pipes and vapor chambers used in the electronic cooling industry.

Application
These different metallic foams are characterized by different properties and attributes which can be used in different applications. Such applications may be found in LEDs, batteries, electrolyzers, fuel cells, as well as air, soil and water treatments to name a few.

Feature
Excellent mechanical property and process ability
Extraordinary electricity and heat conductivity
Massive three- dimensional network structure
Excellent base & corrosion resistant ability
Magnificent electromagnetic shielding ability
Superior tensile strength and favorable ductility



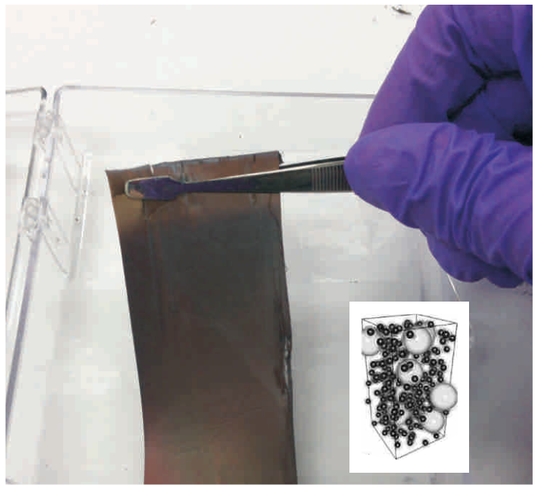
Specifications	Copper	Nickel
Number of pores per inch(PPI)	5-120	5-120
Density (g/cm3)	0.15-0.45	0.15-0.45
Thickness	0.5-- 30mm	0.5-- 30mm
Porosity	90%-- 98%	90%-- 98%
Standard size	500*500mm; thickness under 4mm can be made into roll shape.	

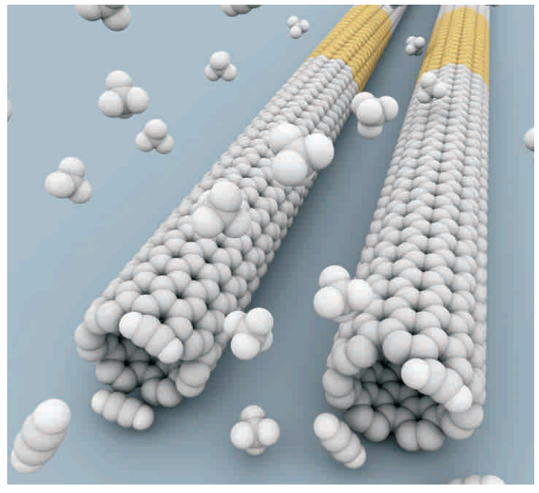
Nano Innovative Materials
Nanoshel Conductive Nanotubes (CALIB)

Composite Additive for LI Battery

Nanoshel Conductive Nanotubes Composite (CALIB) is a Carbon Nanotubes based Conductive Additive for Lithium Ion Battery and other applications. It is a Nano Composite Material specifically designed for improving Lithium Ion Battery Performance

It is composed of Carbon Nanotubes and of grain electrode conductive additives. By adding grain electrode conductive additives to Carbon Nanotubes, the entangled Nanotubes are well separated.
More important, CALIB is very easy to be dispersed in Li-ion battery electrode, and the CNTs network can ensure the Li-ion battery having the best cycle performance, after adding Conductive Nanotubes Composite additive, the tap density of battery electrode coatings can be increased by 10%.





Property	Unit	Value
Carbon Nano Tube Diameter	Nm	20-30
Carbon Nano Tubes Length	μm	15-25
Nitrogen Surface Area	M2/g	60-75
Absorption Value	Ml/100g	>500
Density (in the bag)	g/cm3	0.18
Volume Resistivity	O.cm	2~5x10-4
Moisture (as packed)	%	0.2-0.3
Ash Content	%	0.2 max
Ni (Nickel)	%	0.005 max
Fe (Iron)	PPM	<40
Mg (Magnesium)	PPM	<35
Appearance	Powder	Black Powder
pH		8-9

Nano Innovative Materials
Pyrolytic Graphite

Pyrolytic Graphite Plate: HOPG Substrate Materials for Scanning Tunneling Microscopy and Atomic Force Microscopy Pyrolytic Graphite (Substrate Nucleated) plate is manufactured by decomposition of hydrocarbon gas at very high temperature in a vacuum furnace.
PGS (Pyrolitic Graphite Sheet) is a thermal interface material which is very thin, synthetically made, as high thermal conductivity and is made from a High Oriented Graphite Polymer Film. Its ideal for providing Thermal management/heat-sinking in limited spaces or to provide supplemental heat - sinking in addition to conventional means. This material is flexible and can be cut into customizable shapes.

Features
Excellent Thermal Conductivity(2-4 times as high as copper, 3-6 times as high as Aluminium)
Light Weight: 0.852 to 2.1g/cm3
Specific Gravity: 1/4 to 1/10 of copper , 1/1.3 to 1/3 of Aluminium in density
Flexible and easy to be cut or trimmed
Low thermal resistance
RoHS compliant

Application
Cellular phone, DVC, DSC, PC and Peripherals
Semiconductor manufacturing equipment
Optical communication equipment

PROPERTIES

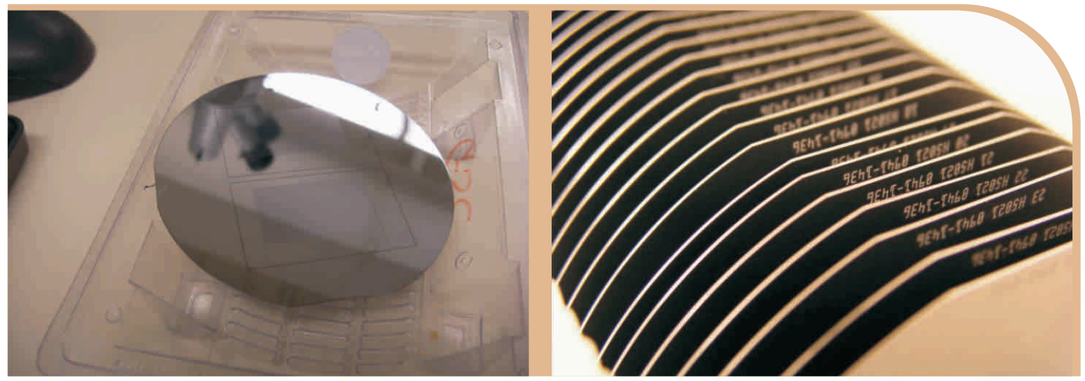
Density	2.2 gr/cm^3
Flexural Strength –AB	103.4 mpa
Compressive Strength – C	172.4 mpa
Shear Strength – AB	6.9 mpa
CTE – AB	0.5 microns/m °C
CTE – C	11 microns/m °C
Thermal Conductivity – AB	400 W(m^2 , K/m)
Thermal Conductivity – C	3.5 W(m^2 , K/m)
Resistivity (RT) AB	0.5 * 10 -^{3} ohm x cm
Resistivity (1650C) AB	0.3 * 10 -^{3} ohm x cm
Resistivity (RT) C	0.5 ohm x cm
Resistivity (1650C) C	0.3 ohm x cm
Oxidizing Atmosphere	649 °C
Method of Manufacturing	Hydrocarbon gas decomposition

Specification

Density	2.250-2 .266 g/cm3
Level spacing	0.3344 - 0.3359 nm
Sizes Available	10x10x1 (mm), 12 x 12x 1 (mm)

NANOSHEL® Creating Miracles in Black

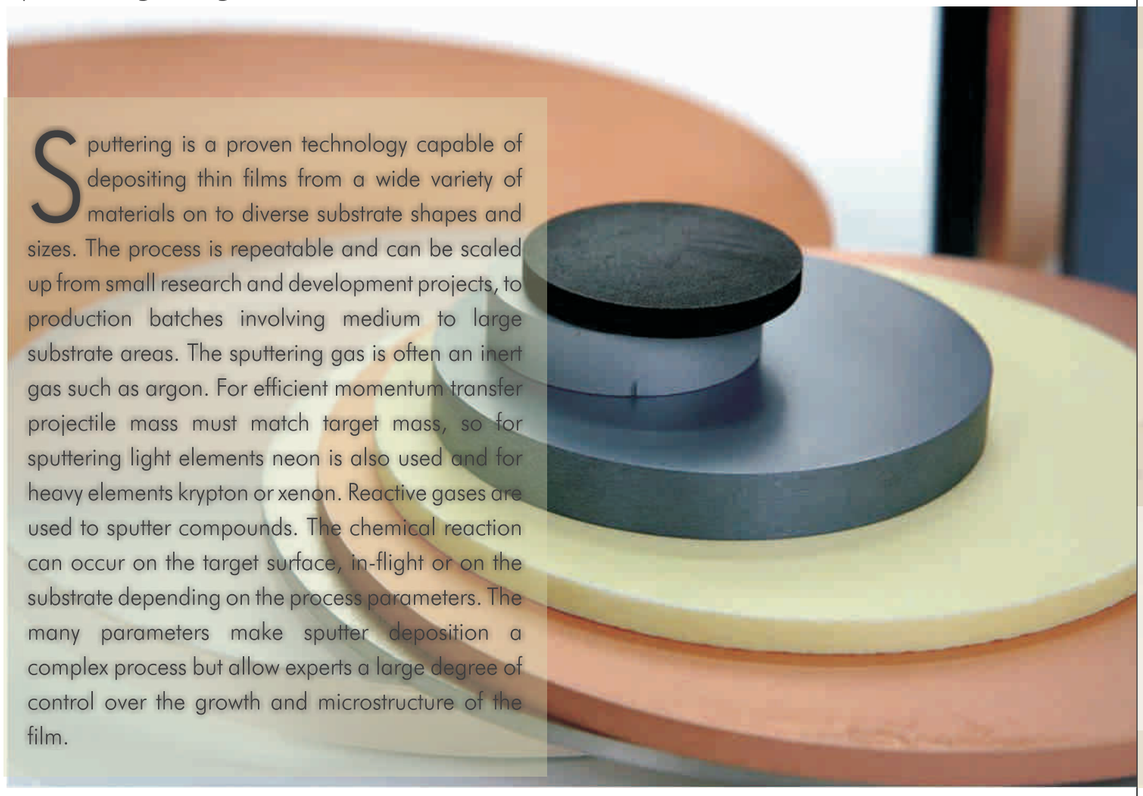
Nano Innovative Materials
Nanoshel Monocrystalline Silicon Wafers



More than 90% of the earth's crust is composedof Silica (SiO_2) or Silicate, making silicon the second most abundant element onearth. When sand glitters in sunlight, that's silica. Silicon is found in myriad compounds in nature and industry. Most importantly to technology, silicon is the principle platform for semiconductor devices. The most advanced semiconductor technologies of today and tomorrow require monocrystalline Silicon with precise uniform chemical characteristics, for instance controlled dopant and oxygen content. The process to transform raw silicon into a useable single-crystal substrate for modern semiconductor processes begins by mining for relatively pure Silicon Dioxide. Most silicon now is made by reduction of SiO_2 with Carbon in an electric furnace from 1500 to 2000°C. With carefully selected pure sand, the result is commercial brown Metallurgical Grade Silicon of 97% purity or better. This is the silicon eventually used for semiconductors, but it must be further purified to bring impurities below the parts-per-billion level.

Parameter	Characteristic
Type/Dopant	P Boron, N Phosphorous, N Arsenic
Orientations	<100>, <111>
Oxygen Content	10-20 ppmA
Carbon Content	0.5 – 1.0 ppmA
Resistivity ranges	
P Boron	0.001 – 50 ohm cm
N Phosphorous	0.1 – 40 ohm cm
N Arsenic	< 0.005 ohm cm
Mechanical Properties	
Diameter	2'' ± 0.008'' - 6'' ± 0.008''
Thickness	279 ± 20 μm (standard) - 500 ± 25 μm
TTV	< 5 μm - < 15 μm
Bow	< 38 μm
Wrap	< 38 μm
Edge Rounding	SEMI-STD
Marking	Primary SEMI-Flat only, SEMI-STD Flats

Nano Innovative Materials
Sputtering Targets



Sputtering is a proven technology capable of depositing thin films from a wide variety of materials on to diverse substrate shapes and sizes. The process is repeatable and can be scaled up from small research and development projects, to production batches involving medium to large substrate areas. The sputtering gas is often an inert gas such as argon. For efficient momentum transfer projectile mass must match target mass, so for sputtering light elements neon is also used and for heavy elements krypton or xenon. Reactive gases are used to sputter compounds. The chemical reaction can occur on the target surface, in-flight or on the substrate depending on the process parameters. The many parameters make sputter deposition a complex process but allow experts a large degree of control over the growth and microstructure of the film.

To achieve the desired characteristics in a sputter deposited thin film, the manufacturing process used to fabricate the sputtering target can be critical. Whether the target material comprises only an element, mixture of elements, alloys, or perhaps a compound; the process to produce that defined material in a form suitable for sputtering thin films of consistent quality is as essential as the deposition run parameters perfected by the thin film process engineers and scientists.

Sputtering Target of all available Metals are available

Composition	Pure Metal Targets, Alloy Targets, Compound Targets Precious Metal Targets (Gold, Silver, Platinum, Palladium, Osmium, Rhodium)
Purity	99 to 99.99%
Diameter	1" (inch) to 10" (inch)
Thickness	1mm to 10mm
Shape	Round, Square, as per customer specification

Nano Innovative Materials
Metal Crucibles

Refractory Metals

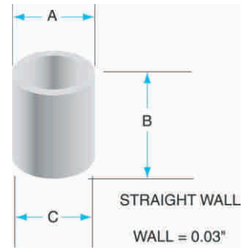
Tungsten | Molybdenum | Tantalum | Nobelium | Rhenium | Silicon

Refractory Metals Products Available

Sheet | Targets | Crucible | Tube | Rod | Wire | Ingot

Application

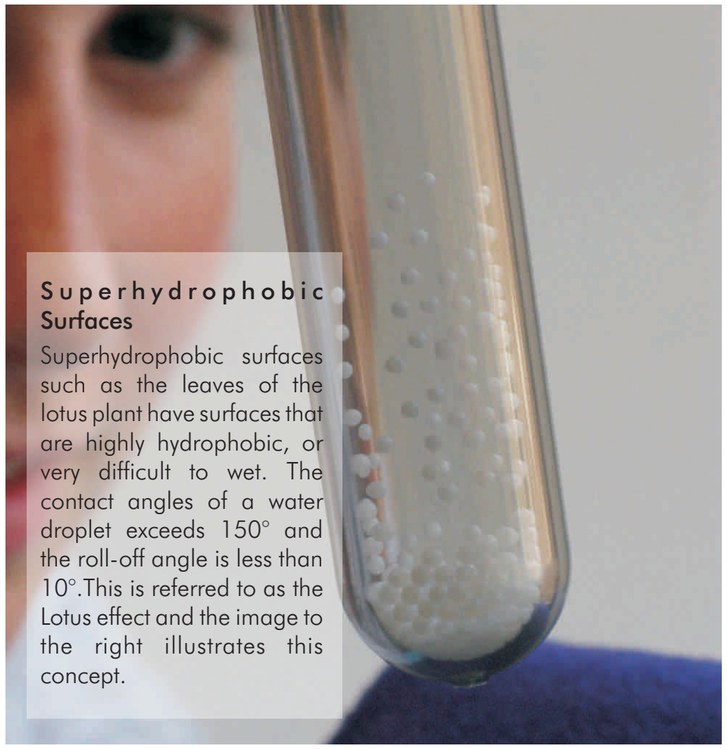
Tantalum crucible is used as container for rare-earth metallurgy, load plates for anodes of tantalum and niobium electrolytic capacitors sintered at high temperatures, corrosion resistant containers in chemical industries and evaporation crucibles and liners.



Commodity	Tantalum crucible or boats
Appearance	Silvery grey metal luster
Purity	Ta⩾99.0%
Density	Not less than 16.0g/cm3
Supply state	Processing or sintering state
Quality standard	GB/T 14841-2008 (tantalum& tantalum alloy bar)
Specification	Φ（20~500）mm×（50~600）mm
Production process	Materials--- machining ---tantalum crucibles
Production equipments	CNC vertical turning machine, CNC milling machine, wire cutting machine

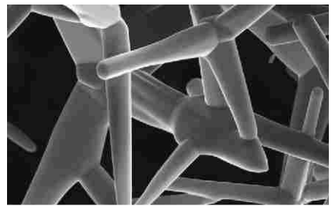
Note : Special specification can be designed according to the customers' requirements.

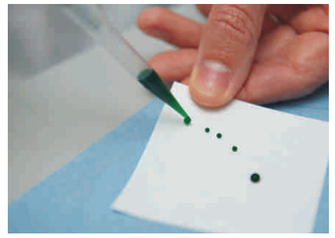
Nano Innovative Materials
Superhydrophobic Surfaces



Superhydrophobic Surfaces

Superhydrophobic surfaces such as the leaves of the lotus plant have surfaces that are highly hydrophobic, or very difficult to wet. The contact angles of a water droplet exceeds 150° and the roll-off angle is less than 10°.This is referred to as the Lotus effect and the image to the right illustrates this concept.





Hydrophobic Effect

Hydrophobic comes from the word hydro (water) and phobos (fear). It can be demonstrated by trying to mix oil and water. And, also is evident if you look at some leaves and flower petals that repel water in droplets after a rain storm. For the leaves, the water repellant can sometimes be a waxy coating on the leaves, or can be the existence of tiny hairlike projections off the surface of the leaf which causes a buffer of air between the hairs – the air keeps the water away.

Fabric Applications

Scientists and engineers who were aware of the hydrophobic effect decided to apply nanotechnology to the surfaces of fabrics to make them water proof too! The waterproof feature often also helps protect fabrics from staining because liquid cannot easily soak into the fabric fibers. A good example is adding nano "whiskers" to cotton fibers in the same way that some
leaves have little "hairs" on their surface. Creating the effect for fabric is a little tricky – a cotton fiber is shaped like around cylinder, and add tiny nano "whiskers" all around the cylinder so it has a fuzzy surface.
The fabric doesn't appear any different or feel any different, but it does repel liquids. And, because liquids do not soak into the fabric, the process also helps the fabric resist staining too.

NANOSHEL® Creating Miracles in Black

Nano Innovative Materials
Nanoclays for Nanocomposite

Nanoshel Nanoclays are derived from naturally occurring clay mineral especially purified and processed in order to obtain nanoclay suitable for the production of a nanocomposite material. Polymer-clay nanocomposite represents one of the most interesting classes of materials developed in recent years. Nanocomposite provide dramatic improvements if compared with virgin polymers. Moreover the content of nanoclay is often included in the following range: 2-5% weight.

Some of the most important improved properties are the following:

- Flame retardancy and thermal stability
- Mechanical properties: stiffness, melt fracture reduction, tension, compression and bending
- Barrier properties to oxygen, CO2, vapor barrier and solvent resistance

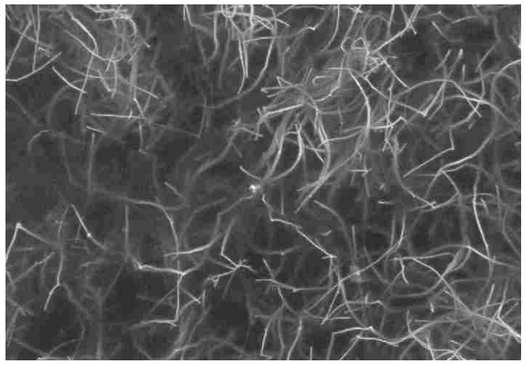
Some of the opportunities for Adhesives and Sealants are following:

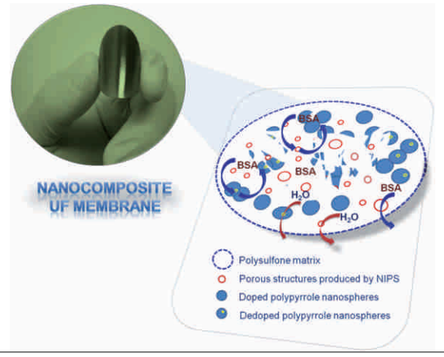
- Rheology control : Nanomaterials maintain low viscosity even at very high levels of loading. Nanoparticles have been noticed to achieve 40-60% loadings without adverse effect on rheology.
- Mechanical properties : High filler loadings and the unique aspect ratios of Nanoparticles make them ideal reinforcing fillers.
- Anti-microbial properties : Active elements are far more available and effective in nano-form.
- Coating thickness reduction : Coating thickness can be reduced by virtue of the high solids content at low viscosity; thus, thinner coatings can be produced with better coating uniformity.
- Tagging security applications : Nanomaterials can be tagged for tractability with various elements. They also can be made magnetically or optically active.
- Ceramic adhesives : Nano ceramic powders can be made to have properties and application characteristics similar to organic adhesives. Thus, one could have a very high temperature and chemical resistant adhesive that is as easy to apply as an epoxy.

Stock Number	Product Description	Application
NS6130-09-901	Clay Nanopowder, >99%, 80 -150 nm	Rheology control
NS6130-09-902	Montmorillonite Nano Clay, >99%, <80nm	Coating thickness reduction
NS6130-09-903	Perlite Nano Clay, >99%, <80nm, 80 -150 nm	Tagging security applications
NS6130-09-904	Expanded Perlite Nano Clay, >99%, 80 -150 nm	Tagging security applications
NS6130-09-905	Zeolite Nanopowder, >99%, <80nm	Ceramic adhesives
NS6130-09-908	NanoClay (Modified COOH), >99%, <80nm	Ceramic adhesives

Many aerospace applications require electrically conducting polymer based composites for static discharge, electrical bonding, interference shielding, primary and secondary power, and current return through the structure. Existing carbon fibre reinforced polymer composites are unable to achieve all these requirements due to the presence of insulating resin regions within the composite structure. Secondary conductive materials such as foils, wires, straps and/or coatings have typically been incorporated into the structure to improve the electrical properties and all of which require additional unwanted processing steps.

One of the objectives of the Nanoshel Nanocomposite is improvement of electrical conductivity of composite laminates primarily in order to fulfil the requirements for lightning strike protection but also for electrical grounding, electrical bonding and EMI shielding.





For the improvement of the composite electrical conductivity using:

- Dispersed carbon nanotubes (CNT) in the resin matrix.
- Carbon nanofiller based "buckypapers".

The first solution involves the addition of conductive particulates in the matrix itself. Recent studies have showed that a small amount of multi wall carbon Nanoshel nanotubes (MWCNT) relatively well dispersed into a polyester resin have the ability to reduce the resistivity of the liquid (and solid) polymer by several orders of magnitude.

The addition of Nanoshel MWCNT and other conductive nano-fillers such as carbon nanofibre (CNF) can increase the electrical conductivity of epoxies and BMI resins to a level sufficient to ensure electrical continuity within composite structures. The levels of nano fillers and the dispersion method can then be optimised for improved electrical conductivity. Several dispersion methods will be assessed, including high torque/ high shear mixing, horn sonication dispersion and shear dispersion using a triple rolls mill. The enhanced resins can be used in both the bulk composite as well as highly thermally conductive surface resin layers.

Membrane technology

The nano filtration technique is mainly used for the removal of two valued ions and the larger mono valued ions such as heavy metals. This technique can be seen as a coarse RO (reversed osmosis) membrane. Because nano filtration uses less fine membranes, the feed pressure of the NF system is generally lower compared to RO systems. Also the fouling rate is lower compared to Ro systems

There are two types of membranes

Spiral membranes, cheapest but more sensitive for pollution
Tubular/ straw membranes, the most used membranes seen the costs and effect, shall not easily be polluted

The surfaces from the filter determine the capacity from the filter. Spiral membranes have l the biggest surface area in general and are therefore the most cheapest in use. The surface area from Tubular/ straw membranes is less in general.The pre purifying of the feeding water has a influence on the performance of the installation. The need of pre purifying depends on the feeding water quality.
Installing pre cleaning has the following advantages:
Long-life, Long production of the installation is possible, Simple management
Besides pre cleaning, chemical doses can be taken place to prevent scaling, precipitation on the surface from the membrane.

NANO FILTERING

Silicon carbide (SiC) is a new and revolutionary Nano Filter with superior chemical & mechanical properties. The SiC nano filters have unique advantages of:

Benefits

- Reduce your foot print and system costs
- Fast cleaning, more efficient chemical cleaning
- Unmatched performance in oil/water separation
- Long life time
- Less down time and maintenance

Features

- HIGHEST FLUX for any filtering material
- Chemically inert (pH 0-14)
- Thermally resistant up to 800 °C
- Completely stable in solvents
- Accepts any amount of oxides

Stock Number	Product Description	Application
NS6130-02-206	Silicon Carbide Submicron Powder (SiC, Beta, 99+%, D<1 um)	Chemically Inert
NS6130-02-207	Silicon Carbide Micron Powder (SiC, Beta, 99+%, 1-40 um)	Completely Stable
NS6130-02-208	Silicon Carbide Nanopowder (SiC, Beta, 99+%, <80 nm)	Oil Water Separation

Nano Innovative Materials
Customized Nano Lubricants

Nanoshel provide lubricants, grease and diesel fuel products containing our Nano-D additives which enhances the performance such as longer live span, better lubricity, improved and cleaner combustion, etc.

Any material with particle size less than 100nm (0.1 micron meter) is defined as Nanoparticles. Nanoparticles its reactivity increases with the decrease in size. Smaller the particle size, higher the surface area. Nanoparticles have a very high surface area to volume ratio; due to this a higher percentage of atoms (in Nanoparticles) can interact with other matter. Therefore Surface Area (measured in Square meters per gram) is most important unit of measure for a nano lubricant. Higher the surface area, higher the lubricity.

Nano lubricant powders

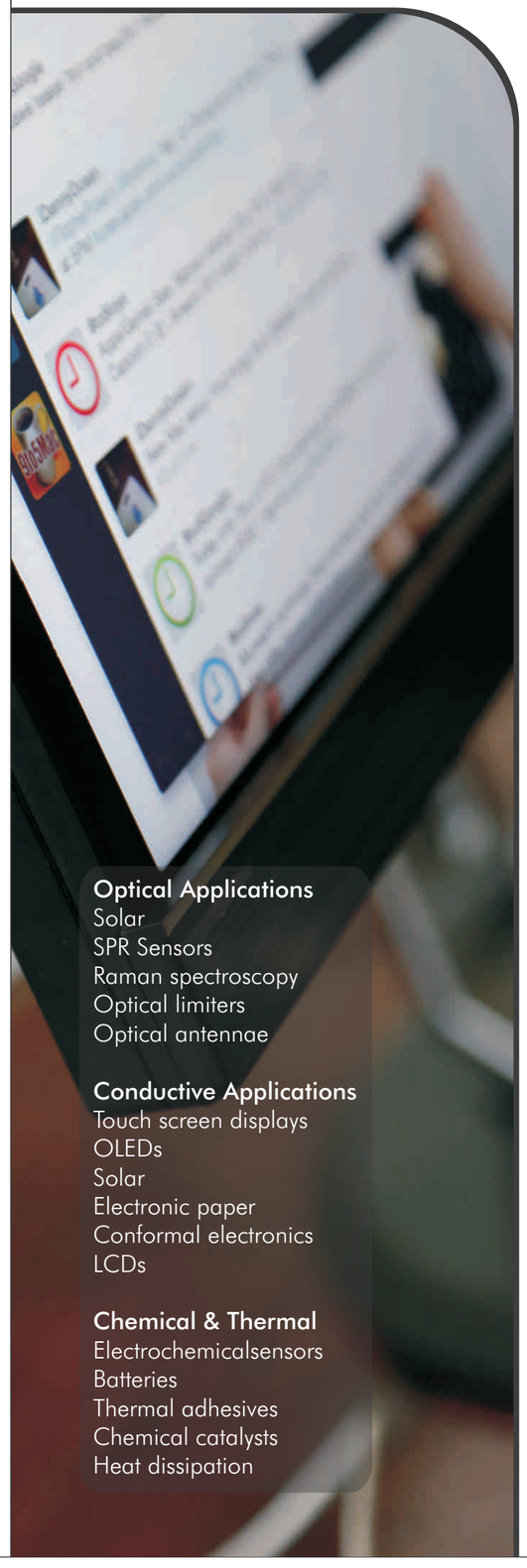
Tungsten Disulfide (WS2) Nanopowder (Purity: 99.9%) - NS6130-02-215
Hexagonal-Boron Nitride (hBN) Nanopowder (Purity: 99.9%) - NS6130-02-201
Molybdenum Disulfide (MoS2) Nanopowder (Purity: 99.9%) - NS6130-02-238
Graphite (nano) Powder (Purity: 99%) - NS6130-01-113

Latest Developments in Nano lubrication

NANOSHEL® utilizes Nano science solutions to meet industrial lubrication challenges and also address the latest developments in corrosion control and fuel enhancement for transportation, marine, industry, and heavy equipment.

NANOSHEL® supplies nano additives for lubricant and grease manufacturers to enhance their products by evolving from toxic and inferior EP/AW additive packages to a more efficient and cost effective nano technology.

NANOSHEL® offers technology made from nano potassium borate, hexagonal boron nitride (hBN), tungsten disulfide (WS_2) plus other advanced complex Nano particle solutions.



Optical Applications
Solar
SPR Sensors
Raman spectroscopy
Optical limiters
Optical antennae

Conductive Applications
Touch screen displays
OLEDs
Solar
Electronic paper
Conformal electronics
LCDs

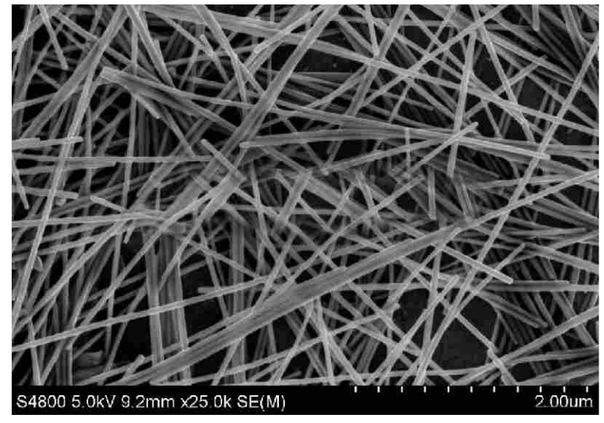
Chemical & Thermal
Electrochemicalsensors
Batteries
Thermal adhesives
Chemical catalysts
Heat dissipation

Nano Innovative Materials
White Polymer Light Emitting Diodes

Silver nanowires used in developing efficient white polymer light-emitting diodes

White polymer light-emitting diodes (WPLEDs) can be used in flat panel displays and solid state lighting due to their solution processability that could lead to low-cost production. In addition, the WPLEDs could also potentially be made flexible and even stretchable. But, recent organic and polymer LEDs all exhibit a large discrepancy between internal quantum efficiency and external quantum efficiency due to their low light outcoupling efficiency.

In order to enhance the low out-coupling efficiency, where most of them were used for ITO/glass substrates. Morever, the plastic substrate, e.g., polyethylene terephthalate (PET) used in flexible LEDs has an even lower out-coupling efficiency for it's high refractive index (nPET = 1.66). Furthermore, the plastic substrates can not survive the high temperatures that some of the enhancement techniques involve.



By employing a silver nanowires (AgNW)–polymer composite as the electrode/substrate to replace ITO/glass, highly efficient WPLEDs can be fabricated. The resulting LEDs have fewer light reflection interfaces. Furthermore, the silver nanowires embedded in the surface layer of the composite electrode/substrate function as scattering centers and suppress the waveguide mode in the polymer layer. The out-coupling efficiency, and thus the luminous efficiency of the WPLEDs are significantly increased as compared to the parallel devices using ITO/glass substrates.

Nano Innovative Materials
Smart Nano Material in Construction Industry

Nano-technology is a dynamic research field that covers a large number of disciplines including construction industry. Concrete is a material most widely used in construction industry. Concrete is a cement composite material made up of Portland cement, sand, crush, water and sometimes admixtures. Interest in nano-technology concept for Portland-cement composites is steadily growing. The materials such nano-Titania (TiO2), Carbon nanotubes, nano-silica (SiO2) and nano-alumina (Al2O3) are being combined with Portland cement. There are also a limited number of investigations dealing with the manufacture of nano-cement. The use of finer particles (higher surface area) has advantages in terms of filling the cement matrix, densifying the structure, resulting in higher strength and faster chemical reactions (e.g. hydration reactions).

Nano-cement particles can accelerate cement hydration due to their high activity. Similarly, the incorporation of nano-particles can fill pores more effectively to enhance the overall strength and durability. Thus nano-particles can lead to the production of a new generation of cement composites with enhanced strength, and durability.

Following is a list of areas, where the construction industry could benefit from nano-technology.

- Replacement of steel cables by much stronger carbon nanotubes in suspension bridges and cable-stayed bridges - Carbon Nanotubes
- Use of nano-silica, to produce dense cement composite materials - Silicon Dioxide Nanoparticles (SiO2)
- Incorporation of resistive carbon nanofibers in concrete roads in snowy areas Incorporation of nano titania, to produce photocatalytic concrete - Titanium Dioxide Nanoparticles (TiO2)
- Use of nano-calcite particles in sealants to protect the structures from aggressive elements of the surrounding environment
- Use of nano-clays in concrete to enhance its plasticity and flowability - Clay Nanopowder
- Urban air quality could be improved by if the civil structures are treated with nano TiO2

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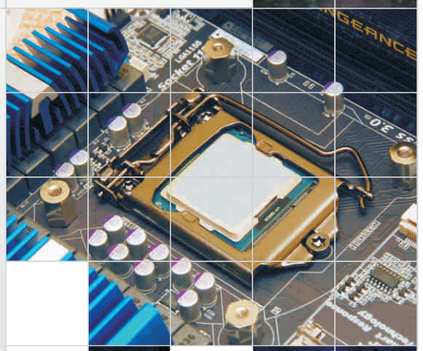
Nano Innovative Materials
Thermal Interface Material

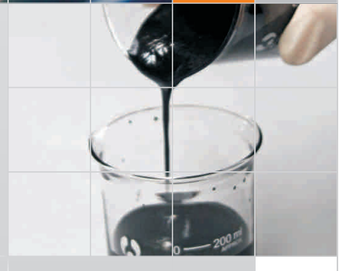
Thermal interface materials (TIMs) are used in electronics packaging to increase heat conduction across the interface between two relatively flat surfaces. A good TIM will have both high conductivity and the ability to conform and contact the surfaces well There are a number of compositions of the TIM, but they typically involve mixtures of a highly conductive filler and a Fluid carrier In some other cases, the TIM may also have the conductive paste on a metallic foil to stabilize the thickness of the material. The particle Filler are often highly conductive metals such as silver or copper particles. Performance of a TIM is based on the ability of the paste to Flow and contact the surfaces in question while at the same time having very good contacts between the particle Fillers that lead to the maximization of the conduction paths from surface to surface.

Carbon Nanotubes Conductive Paste (TIM)

Properties

Pigment	Carbon Nano Tubes
Color	Black
Viscosity	±20,000 cps
Curing time	120°C for 30 minutes 130°C for 15 30 minutes 140°C for 5 to 10 minutes
Coverage	250 sq.ft / kg
Density	1 kg / l
Sheet resistance	2 mm x 1"- length track
Track resistance	< 12 k ohms [2 mm x 1" x 0.5]
Screen wash	Methyl ethyl Ketone
Max service temp	150°C
Consistency	Screenable thick Paste. High residence on screen
Adhesion	Non scratchable
Screen mesh	T 140S
Screen squeeze	Use solvent resist squeeze
Dilution	Ready to use. If dilution requires, add 2% of ECA by volume (little by little)
Storage	avoid heat exposure & sunlight. Keep in a cool place, do not freeze
Shelf life	6 months under original seal
Usage	Mix the content well before use.
Packing available	500gms, 1kg, and as per customer requirement.





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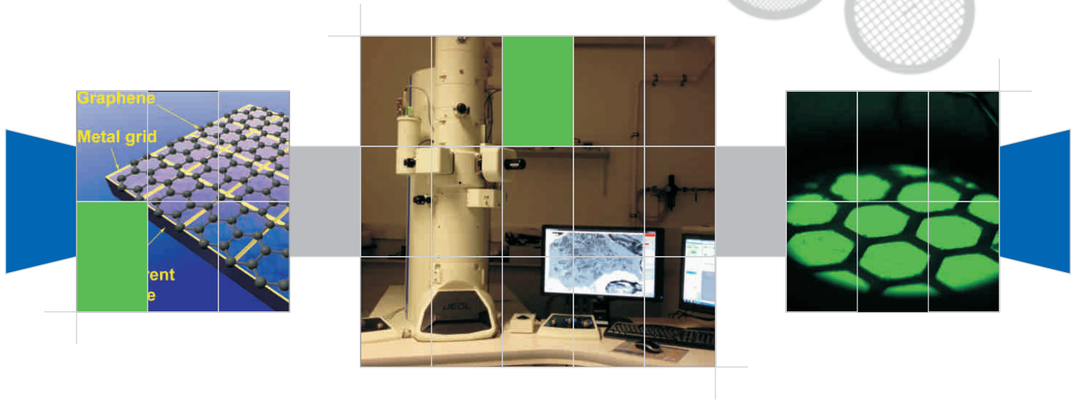
Nano Innovative Materials
Electron Microscope Metal Grids

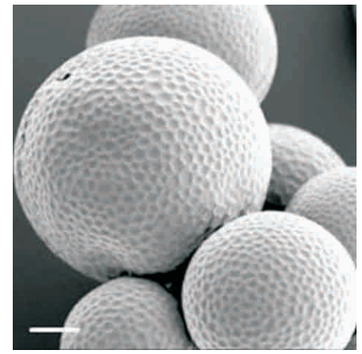
Most biological EM work is done on small (several millimeters) copper discs called grids cast with a fine mesh. This mesh can vary a lot depending on the intended application, but is usually about 15 squares per millimeter (400 squares per inch). On top of this grid, a thin layer of carbon is deposited by evaporating carbon graphite onto it. It is on this thin carbon film that the sample will then rest so that it can be examined in the microscope. Carbon is generally a hydrophobic substance (that is, it repels water), and if a drop of water is placed on it, the water will want to minimize it's contact with the carbon. To make the surface more accessible to water and the suspended sample, the carbon needs to be made hydrophilic. This is accomplished by glow discharging. In glow discharging, the carbon coated grids are placed inside a partly evacuated chamber connected to a power supply. When high voltage is applied between the cathode and anode at each end of the chamber, the electron potential ionizes the gas within the chamber. These negatively charged ions then deposit on the carbon, giving the carbon film an overall hydrophilic (water attracting) surface.

After a small drop of the sample is placed on the hydrophilic grid, it needs to be stained so that the sample can be easily differentiated from the background. Transmission electron microscopy uses a high energy electron beam to bombard the sample. Depending on the amount of energy that was absorbed by the sample, the intensity of the beam that hits the viewing screen varies, and an image is made (remember that contrast arises from the beam interacting with the sample). However, carbon, oxygen, nitrogen, and hydrogen, the main components of biological molecules, are not very dense, and the amount of electrons they absorb is minimal compared to the intensity of the electron beam. Therefore, for normal EM viewing, samples are stained with a heavy metal salt that readily absorbs electrons. This is usually lead, tungsten, molybdenum, vanadium, or depleted uranium. After staining, the sample is blotted, air dried and ready to be examined in the microscope.



Nano Innovative Materials
Silver Coated Microspheres - EMI Shielding

Nanoshel use proprietary process of wet chemistry to coat microspheres with a thin layer of silver that allowed the finished product to perform like silver in electrical conduction and infra-red (IR) reflection AND simultaneously perform like a ceramic in thermal insulation, low cost, low maintenance and ease of use. Silver Coated Microspheres from Nanoshel are extremely reflective and can exhibit an EMI shielding effectiveness of 60dB from 100 MHz to 25 GHz and higher.



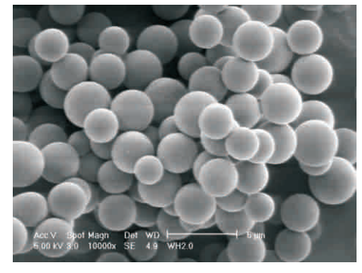
Developed to produce electrically conductive coatings which can be added to tiles, fabrics, adhesives, sealers, plastic, rubber, composite and resin materials. When added at appropriate ratios, these materials can then provide electrical conductivity and shielding of electronic devices against Electro Magnetic Interference (EMI). The low particle density and large surface area facilitates slow phase separation in paints and adhesives compared to heavy metallic and inorganic fillers.

General Information

- High performance with long term conductivity due to excellent oxidation resistance
- Large weight reductions are possible compared to metal powders
- Typical coatings from water base paints show a conductivity of 0.1 to 0.3 ohms per square, depending on thickness

Typical Physical Parameters

Substrate Microspheres	Hollow, Ceramic Magnetic Particles
Appearance	Light Gray to Light Tan Powder
Particle Size	5 - 70 Microns in Diameter
Silver Thickness	500 – 600nm
Mechanical Strength	Approximately 3800 psi
Heat Resistance	960° degrees C (Melting Point of Silver)
Ceramic Stable	1,200° C
Specific Gravity	0.38 Apparent Tamped
Apparent specific gravity	0.38
True specific gravity	0.69



Note

Material can be sprayed, calendared or injection molded under proper conditions
Compatible with most binder systems
Conductivity generally begins at loadings of 30% by volume

Nano Innovative Materials
Aluminium Paste

This is made from aluminium foil or aluminium powder, depending on the end use, by ball milling in white spirits solvent with lubricant present. The parameters of milling determine the nature of the product but generally it will be a two- dimensional flake, of a mean size from 8 – 35 microns in diameter (the third dimension is very small 0.1 – 0.5 micron). Dry ball milling in the presence of an inert gas is practised for special end uses. The majority of paste is made from 99.5 – 99.7% aluminium. The solvent component is usually white spirits and/ or naphtha, but special products are available with other solvents according to use, such as isopropyl alcohol, ethyl acetate, xylene etc. The generic types of product available are: leafing paste & non-leafing paste

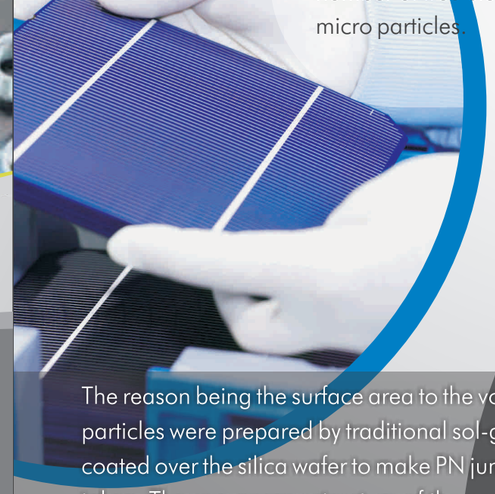
About 80% of all production is leafing paste and the most usual applications are:-
sAnti-corrosion paints sReflective roof coatings with bitumen etc. sFeed to Aluminium flake powder production sPrinting inks

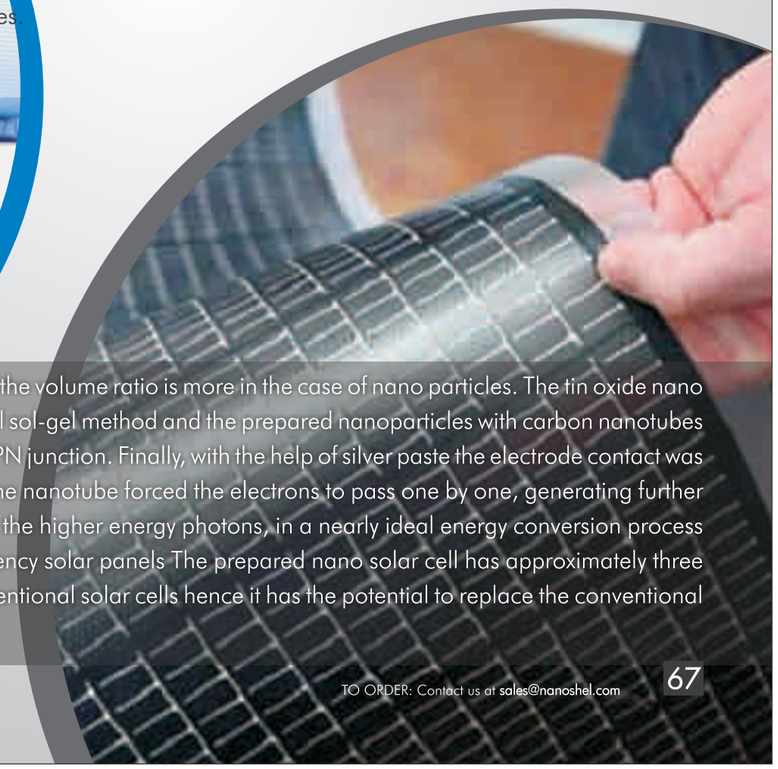
The other 20% of production is non-leafing aluminium paste which has wide application as a coloured paint
pigment. It is used in industrial finishes of many kinds: Hammer finish, coil coating,

Nano Innovative Materials
Nano Solar Cell With Carbon Nano Tubes

Energy is the key input to drive and improve the life cycle. Primarily, it is the gift of the nature to the mankind in various forms. The consumption of the energy is directly proportional to the progress of the mankind. With ever growing population, improvement in the living standard of the humanity, industrialization of the developing countries, the global demand for energy is expected to increase rather significantly in the near future. The primary source of energy is fossil fuel, however the finiteness of fossil fuel reserves and large scale environmental degradation caused by their widespread use, particularly global warming, urban air pollution and acid rain, strongly suggests that harnessing of non-conventional, renewable and environmental friendly energy resources is vital for steering the global energy supplies towards a sustainable path.

Solar energy can play a vital role in narrowing the gap between demand and the supply of the electrical energy. The major hurdle in the usage of the solar cells is there poor efficiency and high cost. The nano solar cells get rid of both the problems, as the nano cells are having high efficiency and fewer costs as compared to the conventional solar cells. The efficiency has be en increased by the implementation carbon nano tubes, which provides a hindrance free path the electrons once it gets energy from the photons. As the fundamental property of nano particle is well that, the number of free electrons on the nano particle surface is very high as compared to the micro particles.

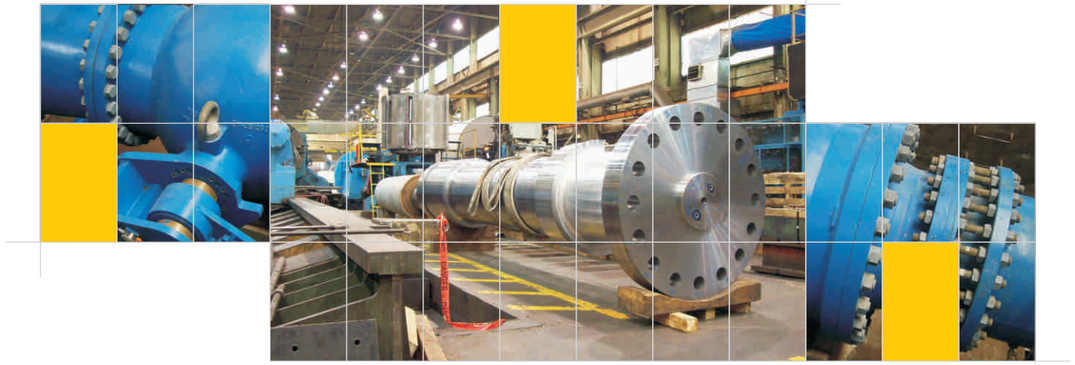




The reason being the surface area to the volume ratio is more in the case of nano particles. The tin oxide nano particles were prepared by traditional sol-gel method and the prepared nanoparticles with carbon nanotubes coated over the silica wafer to make PN junction. Finally, with the help of silver paste the electrode contact was taken. The very narrow structure of the nanotube forced the electrons to pass one by one, generating further electrons with the spare energy from the higher energy photons, in a nearly ideal energy conversion process that could be the key to higher efficiency solar panels The prepared nano solar cell has approximately three times higher efficiency than the conventional solar cells hence it has the potential to replace the conventional solar cells.

Nano Innovative Materials

Nanotechnology Solution for Hydro Abrosive Erosion



Hydro-abrasive erosion due to high concentration of hard particles results in high revenue losses due to productivity losses, efficiency reduction and repair work and outage times. The damages can be so high that the mechanical integrity of the turbines is not given anymore, which could lead to severe accidents. Use of a hard coating of Nanomaterials like WC (Tungsten Carbide) on the runners and related components at the 1,500 MW Nathpa Jhakri plant in India significantly decreased damage as a result of hydro abrasive erosion. The coated units have operated successfully through the monsoon season with minimal damage.

Hydro-abrasive erosion is dependant of the particle parameters (concentration, mineral composition, particle size distribution and shape) and on the turbine and operation parameters. The particle parameters are dependent on the water source. Rivers in relative young geological formation have a high particle load during the monsoon season or the snow melting period. In addition, the abrasiveness of these particles highly depends on the constitution of the rocks in the catchment area, so that these particles can be mainly hard particles like quartz, magnetite, feldspar and zircon. In addition, based on the geography, hydro power plants have often no extensive reservoir in which a substantial sedimentation can take place, but are run-of-the-river hydro power plants.

Stock Number	Product Description	Application
NS6130-02-207	Silicon Carbide Micron Powder (SiC, Beta, 99+%, 1-40 um)	Completely Stable
NS6130-02-208	Silicon Carbide Nanopowder (SiC, Beta, 99+%, <80 nm)	Oil Water Separation

The particle shape is mainly angular or only sub-rounded, which increases the aggressiveness of the particles. During the monsoon, soil erosion in the catchment area increases, and about 99% of the entire amount of particles are transported during four to five months (May to September). But particle loads fluctuate significantly over the years and can vary between the lowest and highest yearly average by a factor of three. Abrasive particles in the water resulted in significant damage to the runners (left) and guide vanes (right) of the four units in the 1,500 MW Nathpa Jhakri facility. These damages can be repaired easily

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Product List

Product List 1 - Metal Nano Powder
Product List 2 - Nanopowder Compounds
Product List 3 - Oxide Nanopowder
Product List 4 - Nanopowder Dispersions
Product List 5 - Single Walled Carbon Nanotubes
Product List 6 - Multi Walled Carbon Nanotubes
Product List 7 - Alloy Nanopowder
Product List 8 - Micro Powder
Product List 9 - Clay-Shape Memory Polymer
Product List 10 - Silicon Wafer
Product List 11 - Sputter Targets
Product List 12 - Innovative Materials

Nanobased Product Listing