

Information on Nano technology

- Nanotechnology could help meet the need for affordable, clean drinking water through rapid, low-cost detection of impurities in and filtration and purification of water. For example, researchers have discovered unexpected magnetic interactions between ultrasmall specks of rust, which can help remove arsenic or carbon tetrachloride from water (see image); they are developing nanostructured filters that can remove virus cells from water; and they are investigating a deionization method using nano-sized fiber electrodes to reduce the cost and energy requirements of removing salts from water.



- Nanoparticles will someday be used to clean industrial water pollutants in ground water through chemical reactions that render them harmless, at much lower cost than methods that require pumping the water out of the ground for treatment.

Nanorust cleans arsenic from drinking water.
(Image courtesy of Rice University)

Described below is a sampling of the rapidly growing

list of benefits and applications of nanotechnology.

Most benefits of nanotechnology depend on the fact that it is possible to tailor the essential structures of materials at the nanoscale to achieve specific properties, thus greatly extending the well-used toolkits of materials science. Using nanotechnology, materials can effectively be made to be stronger, lighter, more durable, more reactive, more sieve-like, or better electrical conductors, among many other traits. There already exist over 800 everyday commercial products that rely on nanoscale materials and processes:

- Nanoscale additives in polymer composite materials for baseball bats, tennis rackets, motorcycle helmets, automobile bumpers, luggage, and power tool housings can make them simultaneously lightweight, stiff, durable, and resilient.
- Nanoscale additives to or surface treatments of fabrics help them resist wrinkling, staining, and bacterial growth, and provide lightweight ballistic energy deflection in personal body armor.
- Nanoscale thin films on eyeglasses, computer and camera displays, windows, and other surfaces can make them water-repellent, antireflective, self-cleaning, resistant to ultraviolet or infrared light, antifog, antimicrobial, scratch-resistant, or electrically conductive.
- Nanoscale materials in cosmetic products provide greater clarity or coverage; cleansing; absorption; personalization; and antioxidant, anti-microbial, and other health properties in sunscreens, cleansers,

complexion treatments, creams andNew nanotechnology-enabled sensors and solutions may one day be able to detect, identify, and filter out, and/or neutralize harmful chemical or biological agents in the air and soil with much higher sensitivity than is possible today. **Researchers around the world are investigating carbon nanotube “scrubbers,” and membranes to separate carbon dioxide from power plant exhaust. And researchers are investigating particles such as self-assembled monolayers on mesoporous supports (SAMMS™), dendrimers, carbon nanotubes, and metalloporphyrinogens to determine how to apply their unique chemical and physical properties for various kinds of toxic site remediation**

- Prototype solar panels incorporating nanotechnology are more efficient than standard designs in converting sunlight to electricity, promising inexpensive solar power in the future. Nanostructured solar cells already are cheaper to manufacture and easier to install, since they can use print-like manufacturing processes and can be made in flexible rolls rather than discrete panels. Newer research suggests that future solar converters might even be “paintable.”

- Nanotechnology is improving the efficiency of fuel production from normal and low-grade raw petroleum materials through better catalysis, as well as fuel consumption efficiency in vehicles and power plants through higher-efficiency combustion and decreased friction.

- Nano-bioengineering of enzymes is aiming to enable conversion of cellulose into ethanol for fuel, from wood chips, corn stalks (not just the kernels, as today), unfertilized perennial grasses, etc.



Nanosys

- New solar panel films incorporate nanoparticles to create lightweight, flexible solar cells. (Image courtesy of Nanosys)
- Nanotechnology is already being used in numerous new kinds of batteries that are less flammable, quicker-charging, more efficient, lighter weight, and that have a higher power density and hold electrical charge longer. One new lithium-ion battery type uses a common, nontoxic virus in an environmentally benign production process.
- Nanostructured materials are being pursued to greatly improve hydrogen membrane and storage materials and the catalysts needed to realize fuel cells for alternative transportation technologies at reduced cost. Researchers are also working to develop a safe, **lightweight hydrogen fuel tank.**