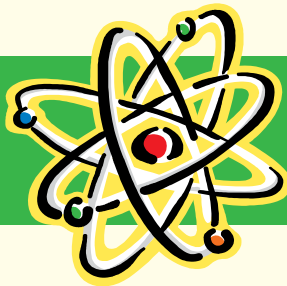


Nanotechnology

Too BIG to Ignore



Small Wonders Indeed!

Nanoparticles have unique physical and chemical properties. Nanomaterials can be added into bulk materials to change their electrical and thermal conductivity, optical properties, and mechanical strength.

Medical Wonders: Worried about getting an infection as you touch the door knob of your classroom?

Worry no more! The door knob can now be coated with antimicrobial silver and titanium nanoparticles that will keep it sanitized all the time! In medicine, nanomaterials are used, among other things, for targeted and controlled drug delivery. In conventional cancer chemotherapy the drug is injected into the body without specifically targeting the affected area and both cancerous and healthy cells are affected. Doctors can now target specific organs with nanoparticles. Researchers at Washington University (St. Louis) have coated nano oil droplets with anti-cancer drugs. These droplets go to the cancerous tumor and deprive it of nutrition. The malnourished tumor shrinks and dies with 1,000 times lower dose of chemotherapy medicine. With lesser amount of toxic drugs, unpleasant side effects are minimized.

Sensitive teeth are usually caused by exposed tooth necks and associated erosion of cementum or enamel. With the protective layer gone, the dentin tubuli are exposed to conduct undesired signals to the nerves in the pulp cavity, thus causing pain. Toothpastes containing biocomposite of nano hydroxyapatite and protein can seal the dentil tubuli by forming a tooth-analogous material. The paste induces crystallization of calcium and phosphate from the saliva to grow the thin protective layer.

Northwestern University researchers are working on use of nanotechnology to enable patients with paralyzed limbs to move and walk. Another research group is using rubbery polymers with tiny (1.3 nm) carbon nanotubes to get flexible (bendable) pads that conduct electricity. The pads will be used in knee and elbow joint repairs in humans.

Rejoice, Messy Kids! Is your mom tired of cleaning stains from clothes? Looks like your bad days are already over. Silicon dioxide (or common silica) nanoparticles are used with hydrophobic (or water repelling) dendrimers to increase washability and stain resistance of clothes. Water repellence, soil resistance, wrinkle resistance, anti-bacteria, anti-static and UV-protection, flame retardation, and improvement of dyeability are the qualities that nanoparticles can enhance in textiles. How about

self-cleaning clothes? Titanium dioxide nanoparticles are photo (light) sensitive and that makes them the perfect candidate for use in self-cleaning clothes. When activated by UV light (present in sunlight) the layer of 5 nm size titanium dioxide breaks down organics deposited on the cloth surface. There are also self-cleaning glass and roof manufactured based on the same principle.

Wearable Electronics and Medicine: The new generation of clothes will have cell phone, iPod, MP3, computer keyboard, pedometer, and even electronic musical instruments 'pasted' onto them. Your clothes will also protect you from UV rays when they are created with titanium dioxide or zinc oxide nanoparticles. And those who suffer from neurodermatitis (a skin condition that causes the skin to become thick and leathery) should expect relief now that silver nanoparticles can be incorporated in your dress fabrics. What a relief!

Nano Invades Computers to Kitchens: Here are some more snapshots. Computers with very large memory (hundreds of GB) are becoming possible with nanotechnology. A 1x1 inch storage drive could have 500,000 GB capacity. Compare to that of your present stick drive of 2 GB! You will be able to store music, movies, e-books and what not! Israeli army is using nanotechnology to create a hornet size flying robot (nicknamed 'bionic hornet') that would be able to chase, photograph and kill its targets. Longer lasting sunscreens are already available on the market. They use titanium and zinc nanoparticles. Ultra light bicycles, lighter and stiffer tennis rackets, baseball bats, hockey sticks, skiing wax, and better aerodynamic tennis and golf balls are examples of sporting goods where nanotechnology is used. Good news for cooks! The wooden spoon for your non-stick cooking pan will no longer be needed with the new scratch resistant non-stick nanocoatings.

On Your Mark: The nanotech market volume is projected to be \$3 trillion by 2015 and the US alone will need two million nanotech trained individuals. It is not surprising that the federal government is investing billions on nano education and research to be the world leader in Nanotechnology Revolution.

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Nanotechnology Applications:

From sunscreen to computers!

NDSU

*Next installment:
Wed., March 10*

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