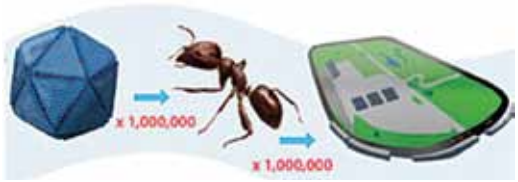
OPEN FOR DISCUSSION

By Barbara Sitzman and Regis Goode

NANOPARTICLES

How small are nanoparticles?



COURTESY OF THE NATIONAL CENTER FOR ELECTRON MICROSCOPY, LAWRENCE BERKELEY NATIONAL LABORATORY, US DEPARTMENT OF ENERGY; HTTP://WWW.SPH.SC.EDU/NEWS/ABOUTNANO.HTM

"Nano" is the metric prefix for 1 x 10^{-9}, so a nanometer (nm) is a billionth of a meter. It comes from an ancient Greek word that means "dwarf." Nanoparticles range from 1 to 100 nm in diameter. Without a microscope, we can only see particles larger than 10,000 nm.

Are nanoparticles really new?

Actually, nanoparticles were already there when the Earth was formed. Sea spray and volcanos spewed nanoparticles into our atmosphere. In the 9th century, Mesopotamian artisans created their pottery glitter with copper and silver oxides finely ground to nano-size.

What is new about nanoparticles is our ability to manipulate matter at the atomic level, opening the door to many new applications. During the past 5 to 6 years, research, development, and consumer interest has been increasingly focused on nanotechnology.

Would you buy a roll-up smart phone?

Paper-thin smart phones are still on the research lab bench. Soon, you may be able to twist nanophones to fit your pocket. T-shirts with carbon nanotubes woven into the fabric are expected to keep them charged.

Check out CHEMMATTERS® online: www.acs.org/chemmatters

Why nanoparticles are so special

When the diameter of particles is 100 nm or less, their chemical and physical properties are unique and quite different from materials made with the same chemical elements but large enough to see. Nanoparticles' unique characteristics are strongly influenced by their size and shape.

Nanoparticle clusters have a large surface-to-volume ratio. This means that most of their atoms sit on the surface, available to collide and ready to react.

These small reactive clusters could one day zoom through our bloodstream for speedy drug delivery or to attack cancerous tumors.

In addition to size, scientists are discovering that the shape of a nanoparticle matters. Flat disks bond best to tumors, and rod-shaped nanoparticles slip into cells at four times the rate of cylindrical nanoparticles.

Nanoparticles with various shapes

Breath sensors could soon replace blood analyses

You feel feverish and miserable, and then your doctor orders tests. But who likes needles stuck into their veins to withdraw a tube of blood? Some clinics already quickly and painlessly analyze the gases you exhale for flu viruses. Breath sensors, composed of gold nanoparticles, carbon nanotubes, and silicon nanowires, help doctors diagnose various medical conditions by analyzing breath in just a few seconds.

Flu viruses can be detected by breath sensors made with silicon nanowires that are present in this face mask.

Should we be concerned about nanoparticles?

We are not fully aware of the health and environmental risks presented by the widespread use of nanoparticles. But scientists are trying to understand the potential risks and benefits of widespread use of nanoparticles.

What questions are left in your mind? What do you think? To keep up-to-date on recent advances in nanotechnology, please go to the Web site of the National Nanotechnology Initiative, the main federal nanotechnology program: http://www.nano.gov/.