

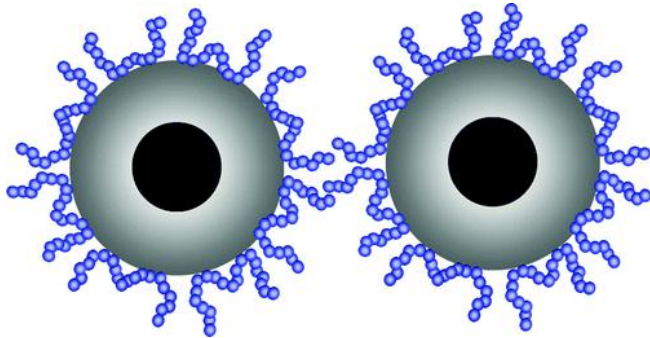
Safety

Safe Nanotechnology in the Work Space

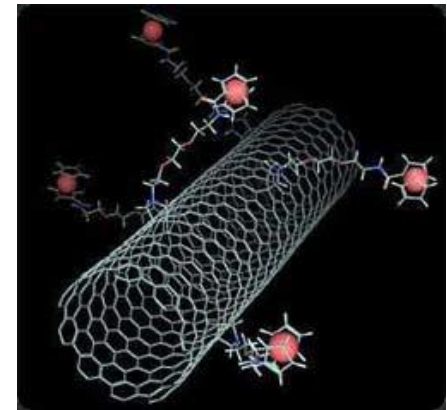
<http://www.cdc.gov/niosh/docs/2008-112/pdfs/2008-112.pdf>

Different types of nanoparticles are made or used in various industrial processes. To determine whether these nanoparticles pose a hazard to workers, scientists must know the following:

- Types and concentrations of nanoparticles in the workplace
- Properties of nanoparticles that could affect the body
- Concentrations of nanoparticles that could produce adverse effects



Iron Oxide Core–Gold Shell Nanoparticles in High Ionic Strength Media
Lim at al., Langmuir 2009



<http://www.nanoshel.com/buy-nanotubes.php>

Safety

Safe Nanotechnology in the Work Space

<http://www.cdc.gov/niosh/docs/2008-112/pdfs/2008-112.pdf>

Effects in animals. Laboratory studies in animals have shown that some types of nanoparticles may reach the blood, brain, and other organs of laboratory animals when they are inhaled. Some studies have shown adverse effects such as inflammation and fibrosis in the lungs and other organs of animals.

Effects in humans. Human studies of exposure and response to engineered nanoparticles are not currently available.

Safety issues in the workplace. Fire and explosion are the main safety hazards associated with nanoparticles in the workplace. Some materials at the nanometer scale may unexpectedly become chemical catalysts and result in unanticipated reactions.

Current exposure standards. No U.S. or international exposure standards have been established for nanoparticles.

Safety

Safe Nanotechnology in the Work Space

<http://www.cdc.gov/niosh/docs/2008-112/pdfs/2008-112.pdf>

Exposure:

Inhalation—The most common route of exposure is by inhalation.

Ingestion—Workers can be exposed by unintentional hand-to-mouth transfer of materials or swallowing particles cleared from the respiratory tract.

Skin—Some studies mention that nanoparticles may penetrate the skin. This possibility is being investigated.

Several factors affect worker exposure to nanoparticles:

- Concentration, duration, and frequency of exposure.
- The ability of nanoparticles to be easily dispersed as a dust (e.g., a powder) or an airborne spray or droplets may result in greater worker exposure.
- Use of protective measures such as engineering controls can reduce worker exposure.

Safety

Schematic of human body with pathways of exposure to nanoparticles (natural and man-made), affected organs, and associated diseases from epidemiological, *in vivo* and *in vitro* studies.

