Nanoparticles and their size may not be big issues

October 24 2011

If you've ever eaten from silverware or worn copper jewelry, you've been in a perfect storm in which nanoparticles were dropped into the environment, say scientists at the University of Oregon.

Since the emergence of nanotechnology, researchers, regulators and the public have been concerned that the potential toxicity of nano-sized products might threaten human health by way of environmental exposure.

Now, with the help of high-powered transmission electron microscopes, chemists captured never-before-seen views of miniscule metal nanoparticles naturally being created by silver articles such as wire, jewelry and eating utensils in contact with other surfaces. It turns out, researchers say, nanoparticles have been in contact with humans for a long, long time.

The project involved researchers in the UO's Materials Science Institute and the Safer Nanomaterials and Nanomanufacturing Initiative (SNNI), in collaboration with UO technology spinoff Dune Sciences Inc. SNNI is an initiative of the Oregon Nanoscience and Microtechnologies Institute (ONAMI), a state signature research center dedicated to research, job growth and commercialization in the areas of nanoscale science and microtechnologies.

The research -- detailed in a paper placed online in advance of regular publication in the American Chemistry Society's journal *ACS Nano* --

focused on understanding the dynamic behavior of silver nanoparticles on surfaces when exposed to a variety of environmental conditions.

Using a new approach developed at UO that allows for the direct observation of microscopic changes in nanoparticles over time, researchers found that silver nanoparticles deposited on the surface of their SMART Grids electron microscope slides began to transform in size, shape and particle populations within a few hours, especially when exposed to humid air, water and light. Similar dynamic behavior and new nanoparticle formation was observed when the study was extended to look at macro-sized silver objects such as wire or jewelry.

"Our findings show that nanoparticle 'size' may not be static, especially when particles are on surfaces. For this reason, we believe that environmental health and safety concerns should not be defined -- or regulated -- based upon size," said James E. Hutchison, who holds the Lokey-Harrington Chair in Chemistry. "In addition, the generation of nanoparticles from objects that humans have contacted for millennia suggests that humans have been exposed to these nanoparticles throughout time. Rather than raise concern, I think this suggests that we would have already linked exposure to these materials to health hazards if there were any."

Any potential federal regulatory policies, the research team concluded, should allow for the presence of background levels of nanoparticles and their dynamic behavior in the environment.

Because copper behaved similarly, the researchers theorize that their findings represent a general phenomenon for metals readily oxidized and reduced under certain environmental conditions. "These findings," they wrote, "challenge conventional thinking about nanoparticle reactivity and imply that the production of new nanoparticles is an intrinsic property of the material that is now strongly size dependent."

While not addressed directly, Hutchison said, the naturally occurring and spontaneous activity seen in the research suggests that exposure to toxic metal ions, for example, might not be reduced simply by using larger particles in the presence of living tissue or organisms.

Provided by University of Oregon