

Exploring Properties—Surface Coatings: Nano-Toss!

Try this!

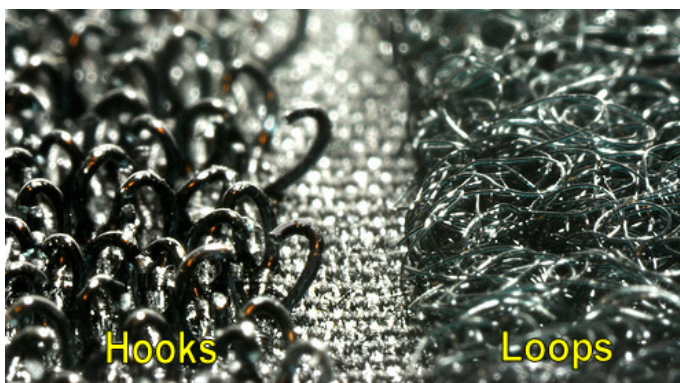
1. Presenter prepares “nano-balls” ahead of time (Attach stickers of Velcro hooks or electrical tape onto ping-pong balls or plastic golf balls to make “nano-balls”.)
2. Visitors experiment with modifying nano-ball’s surface with different coatings: polymers (pipe cleaners), molecules (using more Velcro - either hook or loops layer, or decorative rhinestone-like stickers, or electrical tape.)
3. Visitors throw the coated and uncoated nano-balls at the target (felt-board environmental scene) to test out both coatings.



4. Which type balls sticks to the target better (coated or uncoated)?
5. Compare/predict for different “coatings” and make a nano-ball to take home.
6. Which type “nano-balls” stick more to plants and fish (felt target)? Why does this matter?
7. BACKGROUND POSTER and HANDOUT: (See poster below of more detail on science background) Use large print of poster (or PPT slide) to facilitate discussion of nano-particle coatings with older audiences. Print 8” X10” version of this poster for Handouts.

What’s going on?

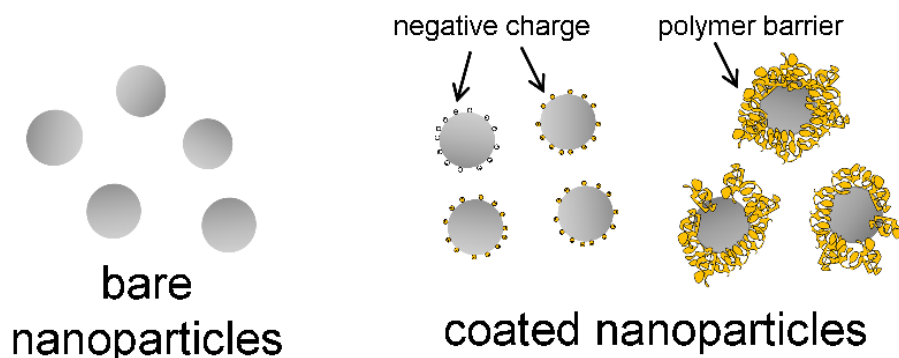
Nanoparticles are like the Velcro-covered balls: The surface coatings on the ping-pong balls change how they interact with other surfaces. The target is made of felt, which has tiny loops on the surface. When the ping-pong balls are coated with Velcro hooks, the hooks grab the loops on the surface and the balls stick. On the other hand, the Velcro loop and electrical tape coatings can’t hook onto the felt target, so those coated balls aren’t sticky. The presence of pipe cleaners (polymer coatings) can affect attachment depending on the location and amount of them on the surface.



(P. Garland, 2009, http://www.flickr.com/photos/paul_garland/3581876336/)

How is this nano?

Surface coatings change the stickiness of nanoparticles and what happens to nanoparticles in the environment. Nanoparticle surface coatings can be small molecules or polymers, which are large chains of molecules. Usually, surface coatings make nanoparticles less sticky. Charged molecules prevent sticking by electrostatic repulsion (“like” charges repel each other). Polymers prevent sticking by creating a barrier between the nanoparticle and other surfaces.



Surface coatings are often used to keep nanoparticles in the “nano” size range by preventing them from sticking to each other. Surface coatings are also important in determining where nanoparticles end up in the environment. Bare nanoparticles usually stick to surfaces like soil, sand, plants, bacteria, and fish. Coated nanoparticles are less sticky and can travel further in the environment.

Learning objectives

This activity demonstrates:

1. How coatings can change the attachment behavior of nanoparticles to surfaces in the environment (like soil, grains, plants) and organisms (fish).
2. How the coatings on nanoparticles will affect where nanoparticles end up in the environment.

Materials

Note to presenters. The Velcro tape comes with both hook and loop sides, so there is no need to prep any with the felt. For the making the foam board target, you can purchase either the felt fabric or some special Velcro loop fabric for multiple, more long term use since the felt eventually loses its capacity to “hold” the nano-balls.

Ping Pong Balls (or practice golf balls with holes)
\$13.55/144pk (\$14.99/48pk)
<http://amzn.to/gteVpY> (<http://amzn.com/B000PGM8A4>)

Velcro Tape (both hook & loop sides)
2x \$24.49/30-ft roll (60 ft total of hook tape & loop tape)
<http://amzn.to/gswRRz>

Electrical Tape
2x \$5.05/66-ft roll
<http://amzn.to/hBczBY>

Felt, 72" x 36" (need to test it with the Velcro)
\$8-\$10
<http://amzn.to/fcGhkl>

Veltex Loop Fabric, 60" width (if the felt doesn't stick well enough)

2x \$14/yd

<http://bit.ly/hIChrO>

Cardboard/foam board (to mount the fabric on)

Pipe-cleaners

Small bumper stickers (e.g. rhinestone stickers, bumper pads, etc.)

Credits and rights

This activity was developed by Dr. Heileen Hsu-Kim, Dr. Glenda Kelly, and Dr. Greg Lowry from the NSF and EPA funded Center for the Environmental Implications of NanoTechnology (CEINT) headquartered at Duke University. CEINT is a research and educational collaboration between Duke, Carnegie Mellon, Howard, and Virginia Tech and Stanford Universities, and the University of Kentucky and other key national and international partners. CEINT's overarching goal is to unravel the role of nanoparticles in ecosystems, their movements through the environment, their interactions with organisms, the mechanisms by which they exert their influence, and thus, their environmental impacts.



This material is based upon work supported by the National Science Foundation (NSF) and the Environmental Protection Agency (EPA) under NSF Cooperative Agreement EF-0830093, Center for the Environmental Implications of NanoTechnology (CEINT). Any opinions, findings, conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the NSF or the EPA. This work has not been subjected to EPA review and no official endorsement should be inferred.

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