

Exploring Products—Kinetic Sand

Try this!

1. Play with the sand in both trays. Poke it. Pick it up. Let it fall slowly from your fingers. What happens? What do you notice about these different sands?
2. Use the tools to make small sand sculptures. Do your sculptures hold their shapes? What happens if you leave them alone for a little while? How do the two sands behave differently?



What's going on?



One of the sands (the Kinetic Sand™) has been coated with a thin polymer layer. The polymer layer is so tiny that an individual grain of sand looks and feels just like regular sand, but a container of it behaves very differently! The polymer coating that gives the Kinetic Sand these unique properties is polydimethylsiloxane (PDMS).

The PDMS coating makes the Kinetic Sand behave more like wet sand. You can sculpt and build with it, but over time, Kinetic Sand creations flow apart and the sand moves in some interesting and surprising ways. We think this odd behavior happens because the polymer coating makes the sand stick to itself. So as a grain of sand moves—even a little—it pulls other grains along with it.

PDMS isn't just used in Kinetic Sand—it's used in many commercial products, including water repellants, lubricating oils, and even anti-gas drops for babies!

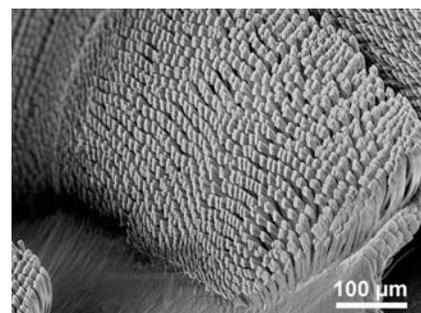
How is this nano?

The way a material behaves on the macroscale is affected by its structure on the nanoscale. You can't see or feel the nano-layer of PDMS on the sand because it's so thin, but you can observe that the Kinetic Sand behaves differently from ordinary sand.

Polymers are important in nanoscale research. For example, scientists at the University of Massachusetts Amherst have used PDMS, as well as other soft polymers, to make a material known as Geckskin™.

The amazing, sticky properties of Geckskin were inspired by real geckos in nature. Geckos are able to walk on walls and cling to ceilings because of the tiny nano-sized hairs on their feet. Geckskin mimics these tiny hairs. Geckos must also be able to lift their toes up and put them back down. Strong tendons in their feet allow them to do this. Geckskin also uses strong stiff, fabrics that act as synthetic tendons to pull on the soft polymer.

Scientists and engineers often try to mimic nature when they're developing new products—we call this *biomimicry*. Biomimicry is especially important in nanotechnology, where engineers are using it to create new electronic displays, drugs, tiny robots, and protective coatings.



Gecko toes have tiny nano-sized hairs that allow them to walk on walls and cling to ceilings

Learning objectives

1. The way a material behaves on the macroscale is affected by its structure on the nanoscale.
2. Nanotechnology takes advantage of special properties at the nanoscale to create new materials.

Materials

- Play sand
- Kinetic Sand™
- 2 trays
- Sand toys

Kinetic Sand™ is available from Waba Fun, www.wabafun.com.

Play sand is available through home improvement stores, such as Lowe's, www.lowes.com.

Notes to the presenter

Kinetic Sand™ was originally developed by a Sweden-based arts and crafts company called Delta of Sweden. The process for making this product is proprietary. We know that the special sand is coated with a nano-thin layer of polydimethylsiloxane (PDMS), but we don't know the exact recipe or procedure.

Before beginning this activity, fill one of the two trays with play sand and the other with Kinetic Sand™. You can reuse the Kinetic Sand™ and the play sand when the activity is over, just carefully transfer them into storage containers or plastic bags. When visitors are playing with the sand, and during clean up, minimize cross-contamination between the two sands!

Important: Don't let the Kinetic Sand™ get wet! It won't ruin the sand, but it will change its properties. If it does get wet, just be sure to leave it out to dry.

Related educational resources

The NISE Network website (www.nisenet.org) contains additional resources to introduce visitors to nanomaterials and consumer products enabled by nanotechnology:

- Public programs include *Aerogel*, *Future of Computing*, *Ink Jet Printer*, *Magic Sand*, *Nanoparticle Stained Glass*, *Sand*, *Plants and Pants*, and *Nanosilver: Breakthrough or Biohazard?*
- NanoDays activities include *Exploring Materials—Ferrofluid*, *Exploring Materials—Liquid Crystals*, *Exploring Materials—Thin Films*, *Exploring Products—Nano Fabrics*, and *Exploring Products—Sunblock*.
- Media include *Everything is Made of Atoms*, *Zoom into a Computer Chip*, and *Multimedia Zoom into a Nasturtium Leaf*.
- Exhibits include *Bump and Roll*, *Changing Colors*, and *Nanotechnology—Fact or Fiction?*

Credits and rights

Image of Geckskin courtesy of A. Crosby and D. Irschick, University of Massachusetts Amherst.



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