UA synthetic gecko foot-hairs leading to reusable adhesives

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The interest of University of Akron polymer researchers in the fascinating ability of geckos to climb any surface and hang from just one toe soon could lead to advances in adhesives used in microelectronics and space applications.

The UA researchers are part of a team developing synthetic hairs from carbon nanotubes that have adhesion forces 200 times higher than those observed with gecko foot-hairs. The team includes Dr. Ali Dhinojwala, UA associate professor of polymer science; UA polymer graduate student Betul Yurdumakan; and Nachiket Raravikar and professor Pulickel Ajayan from Rensselaer Polytechnic Institute in New York.

The results of their work, titled “Synthetic gecko foot-hairs from multiwalled carbon nanotubes,” were recently published in the journal Chemical Communications. The paper can be found online at www.rsc.org/publishing/journal … cle.asp?doi=b506047h .

The research — funded by a four-year, $400,000 grant from the National Science Foundation — studies the powerful adhesion powers of geckos. The lizards' five-toed feet are covered with microscopic elastic hairs called setae. The ends of the setae split into spatulas, which come into contact with a surface and hold the feet in place.

“It is well known that insects such as beetles and reptiles such as geckos have evolved and developed this most effective adhesive system in order to survive,” Dhinojwala says. “The biological system in these creatures

has perfected not only the mechanism to attach to steep vertical surfaces but also to detach at will.

“We already have strong adhesives that can support large forces, and we have weak adhesives such as sticky notes that can be used many times but are not strong enough to support large forces,” he adds. “It will be a challenge to figure out how to design an adhesive that can provide a strong attachment to support a large force but at the same time have the capability of detaching itself from the surface with ease.”

To achieve these objectives, the researchers are fabricating surface patterns to mimic the gecko's setae and spatulas, Dhinojwala explains. The structure is based on multiwalled carbon nanotubes constructed on polymer surfaces.

Dhinojwala says the research, which will continue with experiments with larger surface areas, could lead to improved, reusable dry adhesives that will have critical applications in microelectronics, information technology, robotics, space and other areas.

Source: University of Akron