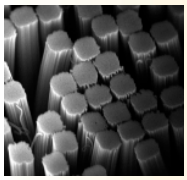
Research at The University of Akron

Gecko-Inspired Adhesives and Tapes

The rapidly growing field of biomimetics has enabled a better understanding of the extraordinary adhesive properties and climbing abilities demonstrated by the gecko. The unique aspects of gecko adhesion result from the complex hierarchal structure of the microscopic hairs, or setae, present on the gecko's footpads. Synthetic routes to mimic nature's magic have been invented.

In this research, gecko-inspired adhesives based on carbon nanotubes have been developed with frictional adhesive characteristics superior to that of the gecko in nature. The microstructure of the gecko footpad has been simulated using carbon nanotube bundles to replicate the microscale setae, while individual carbon nanotubes were used to replicate the nanoscale spatulae present within the setae. Such gecko tapes can support a shear stress nearly four times higher than the gecko foot, and can allow for enhanced adhesion to a variety of substrates including mica, glass, acrylic, and Teflon.® Unlike conventional materials, gecko-based adhesives can adhere to nearly any surface, whether it be hard or soft, rough or smooth, wet or dry. Based on this technology, a flexible adhesive tape has been constructed which maintains its adhesive character and can be used repeatedly without deterioration of the adhesive performance.



With the proper design of size, shape, and pattern of the carbon nanotubes, it has been further discovered that these synthetic gecko tapes can also be self-cleaning. Reversible adhesion and the self-cleaning effect can be demonstrated through either rinsing with water, or by mechanical cleaning of the surface. The results show that the shear stress of the cleaned samples are 60-90% of those for the pristine, unsoiled samples.

Our research has shown that shown that carbon nanotube-based gecko tapes offer an excellent synthetic option as a dry, conductive, and reversible adhesive for use in microelectronics, robotics, and space applications.

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Faculty Inventions and Patents at UA

- Polymer science (88)
- Medical (50)
- Information technology (24)
- Nanotechnology (23)
- Advanced materials (19)
- Biotechnology (7)
- Chemical technology (6)
- Environmental (6)
- Energy (3)
- Security (3)

Research at UA

As the public research university of northern Ohio, The University of Akron is connected to the community and to industry, using research as the driver for finding meaningful solutions to advance the region.

162 – number of active UA patents
6,300,000 – 2007 licensing revenue, leading to a statewide first place ranking in rate of return for technology commercialization
1 – worldwide ranking in patents issued per research dollar spent, according to a five year study by the Milken Institute
24,800 – number of UA students, under the tutelage of 735 full-time faculty members
16 – percentage of UA's $51.7 million 2007 research expenditures funded by industry, the national average is 5 percent

For more information on The University of Akron's research, inventions, and technology, visit www.uakron.edu/research.

About The Faculty Inventor

Dr. Ali Dhinojwala is H.A. Morton Professor of Polymer Science at The University of Akron. After spending several years working in industry, Dr. Dhinojwala joined The University of Akron in 1997. He currently serves as Interim Chair in the Department of Polymer Science, and is active in the newly created Integrated Biosciences program, a unique interdisciplinary experience designed to give students an in-depth, but diversified, knowledge of biological systems. His current research is involved with structure and dynamics at surfaces and interfaces; the complex interrelationships between adhesion, adhesion hysteresis, and friction; and the development of synthetic adhesives using aligned carbon nanotubes inspired by Gecko foothairs.

Invention Information

Title: Aligned Carbon Nanotube-Polymer Materials, Systems, and Methods

Patent Status:	**Pending**
Filing Date:	30 June 2006
Inventors:	Pulickel Ajayan (RPI) Ali Dhinojwala

Title: Aligned Carbon Nanotube-Polymer Materials, Systems, and Methods

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