



Bayer MaterialScience Fights Pain and Infections with Carbon Nanotubes

By Tim Hayes

Imagine a thin sheet, so unobtrusive that you may never even notice its existence, saving you from pain and infection. It's one of the Pennsylvania NanoMaterials Commercialization Center's newest developments, working in partnership with Bayer MaterialScience LLC.

These flexible sensing films, utilizing new Baytubes® carbon nanotubes technology from Bayer, have been developed with the help of the Quality of Life Technology Center, a joint venture between Carnegie Mellon University and the University of Pittsburgh.

The sensing films utilize the mechanical properties of Baytubes® carbon nanotubes, which provide electrical conductivity through their large surface area. By leveraging the benefits of the nanotubes in the final product, the technology will potentially provide flexibility, durability and customization to prevent pressure sores and deep tissue damage for wheelchair users.

"Pressure sores are a big issue for certain at-risk populations, including non-ambulatory people with spinal cord injury, those bedridden in nursing homes and diabetics," explained Mike Gallagher of Bayer MaterialScience. "There are 1.6 million spinal cord patients in wheelchairs worldwide, and nearly 50 percent of the U.S. population is considered obese and susceptible to diabetes. This sensing film product can serve these markets almost immediately. It has been personally rewarding to be part of a project that increases the quality of life for these people."

Gallagher shared studies showing that pressure sores represents \$1.7 billion in cost to the U.S. healthcare industry.

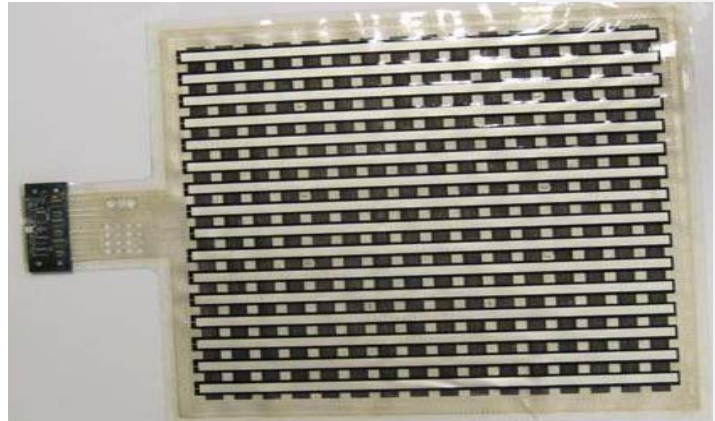
"When the average person is in a chair, you can shift your body if you are uncomfortable, but a non-ambulatory person can't do that," he said. "Sores are caused by pressure, moisture, sliding back and forth, temperature, diet and the physiology of the patient. We developed a device that's thin and flexible, like a film. It measures temperature, pressure, and moisture, so the electronics in this film can tell the patient there's something amiss."

Carbon nanotubes are very small semi-conducting materials that can transmit current. By putting them into coatings and applying them onto flexible film, researchers at Bayer MaterialScience found that they could help in this specific application – informing people that they need to adjust their positions to avoid sores and infections. An interesting future development might be to integrate the sensing film with an actuator that would automatically adjust the patient's position in response to a stimulus. As Gallagher explained, it's like the auto focus on a digital camera – it reads the situation and adjusts accordingly.

"There have been a lot of technical challenges, but with nanomaterials very little goes a very long way," Gallagher explained. "Mixing these nanotubes into conventional coatings and applying them onto film is an easy, inexpensive, and highly effective tool. We always look at developing new materials and add to conventional materials to achieve new applications. We seek out projects like this."

To prove the cost-effective argument, Gallagher said that prototypes of the new sensing film product for use by wheelchair-bound patients cost less than \$1,000. Customized products for this segment attempting to perform a similar function available now cost \$11,000. Of course, more work needs to be done to determine savings potential more precisely.

“The Human Engineering Resource team at Pitt did much of the prototype testing, and the people at CMU did more user-interface development and testing,” he said. “It’s still a work in progress, with additional testing for new devices occurring now.



“A pressure-sensing pad like this has a long approval process with several government agencies. We all want to be assured the final product is safe and effective. Insurance companies also need to recognize the value and include it in their coverage,” Gallagher continued. “Bayer MaterialScience is now exploring new collaborators to carry this technology forward from here. The prototypes will continue to evolve and could find its way into applications like pressure sensory pads for spinal cord patients or foot pads for diabetics. Diabetics can lose feeling in their feet, and they don’t always know they’re at high-risk behaviors and need to get off their feet to get swelling down or avoid infection. The sensing film can be made to look like a little piece of ribbon, but it can do all these things.”

The project was supported by the Pennsylvania NanoMaterials Commercialization Center with funds provided by the Air Force Research Laboratory in Dayton, Ohio. The Center’s Director, Dr. Alan Brown, commented that this project illustrated how university-company partnerships can quickly develop working prototypes of innovative solutions for the medical industry.

