New X-ray device using carbon nanotubes

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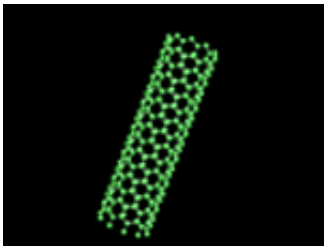

Scientists at the University of North Carolina at Chapel Hill and a UNC start-up company, Xintek, Inc., have invented a new X-ray device based on carbon nanotubes that emits a scanning X-ray beam composed of multiple smaller beams while also remaining stationary.

As a result, the device can create images of objects from numerous angles and without mechanical motion, which is a distinct advantage for any machine since it increases imaging speed, can reduce the size of the device and requires less maintenance.

A report on the promising invention appears in this week's issue (May 9) of Applied Physics Letters, a science and technology journal. The physicists already have received U.S. patents on elements of the work and expect more to be granted.

"This technology can lead to smaller and faster X-ray imaging systems for airport baggage screening and for tomographic medical imaging such

as CT (computed tomography) scanners," said Dr. Otto Zhou, Lyle Jones distinguished professor of physics and materials sciences in UNC's College of Arts and Sciences.

"We believe this is an important advance in X-ray technology, and we are extremely excited about it," Zhou said. "If it works as well as we think it will, other advantages will be that scanners will be cheaper, use less electricity and produce higher-resolution images."

Other authors of the paper are physics doctoral students Jian Zhang and Guang Yang and Dr. Jian Ping Lu, professor of physics and astronomy at UNC, Dr. Yueh Z. Lee of the UNC School of Medicine and Dr. Yuan Cheng, Dr. Bo Gao and Qi Qiu of Xintek, Inc., a Research Triangle Park, N.C.-based nanotechnology company.

Scientists and others, including the news media, have shown strong interest in carbon nanotubes because of numerous potential applications, Zhou said. Discovered about a decade ago, the tiny bits of carbon are very strong tubular structures formed from a single layer of carbon atoms and are only about a billionth of a meter in diameter.

Industrial and university researchers around the world are now developing new devices using the nanotubes, such as field emission flat panel displays, high-strength composites and high energy-density batteries.

The UNC researchers demonstrated that carbon nanotubes might be used as X-ray sources and received their first patent in 2000. Prior to that, conventional X-ray tube design had not changed much in a century.

The nanotube X-ray technology allows the device to be operated at room temperature rather than at the 1,000 degrees Celsius that conventional sources require. It can also be operated as a high-speed X-ray camera,

capturing clear images of objects moving at high speed. The team has now received two U.S. patents on the general concepts of nanotube X-rays. Xintek, the UNC spin-off, is working with several manufacturers to commercialize the technology.

"When fully developed, devices should lead to more effective imaging systems for homeland security," Zhou said.

The new invention can create images of various objects from numerous angles without mechanical motion, he said.

In conventional CT scanners used in airports for baggage screening and in hospitals for diagnostic imaging, the X-ray source is mechanically rotated around objects, including patients, to collect the many projection images required to construct a three-dimensional picture, Zhou said. Existing scanners are large and expensive.

"In addition, the imaging speed is relatively low," he said. "The new scanning X-ray source using nanotubes can electronically produce X-ray beams from different angles without moving. This can significantly increase the imaging speed and reduce the size of the scanner. Making this technology smaller, faster and more accurate should boost the effectiveness of airport baggage scanners significantly."

Xintek Inc., which seeks to develop new industrial and medical applications for carbon nanotubes, resulted from Zhou's group's work. Support for the research has come from the U.S. Transportation Safety Administration, the National Institutes of Health and private sources.