R&D 100 award for inexpensive gamma ray detector device

July 21 2005

Douglas S. McGregor and Walter McNeil have a philosophy: use clever methods to keep things simple.
"You can always add more circuitry to make things complex, but that is just more to break down," McGregor said. "If we keep things very simple and use our knowledge of physics, it turns out that we can make something more reliable and less expensive."

That something is an inexpensive gamma ray detector that for years many scientists deemed too simple to work.

The invention, first introduced by McGregor, a Kansas State University associate professor of mechanical and nuclear engineering, and Ronald Rojeski, of Rojeski Research Engineering and Design, has already been awarded two U.S. patents. Using the patented design introduced by McGregor, McNeil, a K-State mechanical and nuclear engineering graduate student, simply wrapped Teflon and copper tape around a semiconductor block to improve the resolution of the gamma ray detector -- at a fraction of the cost of other techniques.

McNeil built a prototype of the compact, high-resolution device as an undergraduate student during a summer internship at the Brookhaven National Laboratory, in Upton, N.Y., on Long Island. McGregor has since received research funding to develop the detector from the Department of Energy Nuclear Engineering Education Research Program.

The invention received a 2005 R&D100 Award from R&D Magazine for being one of the top 100 most technologically significant products introduced into the marketplace over the past year. The award will be presented to the pair and their colleagues -- scientists from K-State, Brookhaven, Rojeski Research Engineering and Yinnel Tech, Inc. , at a black-tie ceremony in Chicago in October.

"It's quite an honor," McGregor said. " This is a chance to put our names out in front of the scientific community because a lot of people come to see these inventions."

The invention gives scientists an inexpensive way to reproduce the high-resolution detectors -- $150 instead of $5,000.

"It's a step forward in that respect," McNeil said. "More complicated devices like this have existed in technology; we're going further to identify high energy gamma radiation, which can penetrate deeper into material, with a far more simple and inexpensive device."

Perhaps the most practical application for the device is as a gamma ray spectrometer. According to McGregor, the energy resolution of a gamma ray detector is very important in detecting specific energies. The new detector is simpler to manufacture than previous designs and produces much better energy resolution.

"To date, for devices like this, it is the highest resolution that has ever been seen for an uncooled device without customized electronics" McGregor said. " There is no electronic correction, there are no fancy electronics, and it uses an ordinary pre-amplifier.

"With poor resolution, gamma rays cannot be accurately identified. That's why the energy resolution of these devices is so important. The better the energy resolution, the more important the device is as a

spectrometer. Otherwise it's just another radiation counter."

McGregor said the device could serve homeland security purposes, as gamma ray lines are indicative of certain elements in weapons of mass destruction.

"Basically what this does is open up a whole new way of making a gamma ray imaging device," McGregor said. "It can be used for field surveys as a hand-held spectrometer, for medical imaging and for radiation monitoring at a remote location. It requires only a low amount of power."

McGregor and McNeil's design allows for an array of detectors to be stacked, making an imaging device that can detect high-energy gamma rays typically used in medical imaging systems such as PET scanners. These devices could be used in those machines to do a better job of producing medical images. The device, when formed into an array, can be used in medical research to image humans or small animals.

Source: Kansas State University