



Natalia Zaitseva examines the new plastic developed at Lawrence Livermore National Laboratory. The instrument she holds produces UV light that causes the material to glow blue.

Although plastic scintillators have long been used to detect ionizing radiation, until now scientists did not believe it possible to formulate a plastic that could discriminate neutrons from the far more plentiful gamma rays. Unlike ^3He detectors, which pick up thermal, or low-energy, neutrons, the polymer developed at LLNL scintillates with high-energy neutrons, the type emitted by the fissile isotopes uranium-235 and plutonium-239. David Beach, program manager for special nuclear materials movement, radiation detection, and advanced materials at the National Nuclear Security Administration, says those fast neutrons can “punch through” significant amounts of shielding and are detectable up to tens of meters away from their source. Moreover, since the background level for fast neutrons is two orders of magnitude lower than that of thermal neutrons, detecting just a few fast ones, Beach notes, is sufficient to indicate the presence of weapons-usable materials.

Eljen Technology, which manufactures organic scintillators and has produced samples of the plastic for LLNL, is now working to scale up the manufacturing process. An LLNL spokesman says Eljen, located in Sweetwater, Texas, is in licensing negotiations, and two other companies have also expressed interest in licensing the technology.

According to Beach, portal monitors containing the new material could be ready for testing within two years, with handheld detectors to follow. Natalia Zaitseva, the principal investigator on the LLNL team, is confident that the material will also find broad applications in neutron imaging and other scientific applications. “For scientific experiments, it will definitely replace all liquid scintillators,” she predicts.

Zaitseva says that scientists who work with neutrons have been contacting her ever since the research was published online in December in the journal *Nuclear Instruments and*

Methods in Physics Research A. The paper details how the LLNL team developed a polyvinyl toluene polymer matrix loaded with a scintillating dye, 2,5-diphenyloxazole (PPO). The research team describes how the relative ease of fabrication and the deployment advantages of the plastic compared to liquid scintillators make it suited for use in “large-volume and low-cost neutron detectors.”

“The most important part of our work is to show that plastics are capable of doing this,” says Zaitseva. For scintillation to occur, she explains, neutrons must interact with two PPO molecules in the plastic’s matrix. The team achieved the right distance between the two molecules for scintillation by iteratively increasing the concentration of PPO until the threshold was reached. Zaitseva’s team is now striving to develop a plastic that will detect thermal neutrons, the kind that are picked up by the ^3He tubes in most portal monitors now in use.

David Kramer

news notes

Reactor resurgence. On 9 February the US Nuclear Regulatory Commission (NRC) approved construction of the nation’s first new reactors since 1978. Two Westinghouse AP1000 pressurized water reactors, to be built near Augusta, Georgia, are the first to receive approval under the NRC’s new, speedier licensing scheme. Implemented by the Bush administration in 2007, the scheme combines both construction and operational licenses.

Gregory Jaczko, NRC chairman, had indicated reservations about the current licensing procedures in a speech at the annual Platts Nuclear Energy conference just hours before the NRC’s 4 to 1 vote was taken. Jaczko cast the sole dissenting vote. In his speech, he asked whether the industry should develop more detailed risk analysis for events such as last year’s accident in Fukushima (see *PHYSICS TODAY*, May 2011, page 18). “We have done a great job of reducing the number of smaller accidents,” he said, “but what [Fukushima] tells us is that we have not done enough to prevent the significant accidents.”

Assuming legal challenges by environmental groups do not halt construction, the first of the new reactors will come online in 2016, and the second a year later. Another 20 reactors are going through NRC’s review process, but few are expected to be built. Two AP1000 reactors are under construction in China. **PKG**

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