Glowing Films Developed by UC San Diego Chemists Reveal Traces of Explosives

May 23, 2008

Susan Brown

New spray-on films developed by UC San Diego chemists will be the basis of portable devices that can quickly reveal trace amounts of nitrogen-based explosives.

Contaminated fingerprints leave dark shadows on the films, which glow blue under ultraviolet light. One of the films can distinguish between different classes of explosive chemicals, a property that could provide evidence to help solve a crime, or prevent one.

A recent episode of CSI: Miami featured the technology, which linked fingerprints left on a video camera to a bomb used in a bank heist, revealing the motive for the robbery. In real life, the security systems company RedXDefense has developed a portable kit based on the technology that security officers could use with minimal training.

Detection relies on fluorescent polymers developed at UCSD by chemistry and biochemistry professor William Trogler and graduate student Jason Sanchez. "It's a very intuitive detection method that doesn't require a scientist to run," Trogler said.

Sanchez and Trogler describe the synthesis and properties of their polymers in a forthcoming issue of the *Journal of Materials Chemistry*.

The polymers emit blue light when excited by ultraviolet radiation. Nitrogen-based explosive chemicals such as TNT quench that glow by soaking up electrons.

Because the polymers fluoresce brightly, no special instruments are needed to read the results. Only a very thin film sprayed on a suspect surface is needed to reveal the presence of a dangerous chemical. A single layer of the polymer, about one thousandth of a gram, is enough to detect minute amounts of some explosives, as little as a few trillionths of a gram (picograms) on a surface a half-foot in diameter. Handling explosives can leave 1,000 times that quantity or more stuck to fingers or vehicles.

The films also adhere directly to potentially contaminated surfaces, making them more sensitive than previous methods, which rely on capturing molecules that escape into the air.

Detection can be fast, revealing incriminating fingerprints as soon as the solvents dry, within 30 seconds. Exposure to ultraviolet light for an minute or two alters one of the films so that traces a nitrate esters, a class chemicals that includes the highly explosive PTEN, begin to glow green. Traces of other classes of explosives, such as nitroaromatics like TNT, stay dark.

Trogler's group is currently developing similar systems to detect explosives based on peroxides.

The Air Force Office of Scientific Research and RedXDefense funded the research. Sanchez was supported by the National Science Foundation.

Trogler serves on the strategic advisory board of RedXDefense, which has licensed the technology from UCSD.

Comment: William Trogler, 858-534-6175 Media Contact: Susan Brown, 858-246-0161