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A BREAKTHROUGH IN ULTRA-BRIGHT INFRARED LUMINESCENT PARTICLES

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SBIR COMPANY NAME: NanoScience Solutions LLC Arlington, VA

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With support from the Air Force SBIR/STTR Program, a small business created ultra-bright infrared fluorescent particles. Labels made from the particles are invisible without the use of special flashlights and goggles, so they can help distinguish friendly forces from adversaries in combat, as depicted here. (Photo illustration courtesy of NanoScience Solutions)

ADVANCED PARTICLES OFFER POTENTIAL FOR BETTER SECURITY FOR SPECIAL OPERATION FORCES

A new technology developed by a Virginia-based small business could revolutionize the process of tagging and detection during field operations.

With support from the Air Force Small Business Innovation Research/Small Business Technology Transfer Program, NanoScience Solutions LLC created ultra-bright infrared fluorescent particles. Labels made from the particles are invisible without the use of special flashlights and goggles, so they cannot be detected by enemy forces.

This advancement can provide an advantage to special operations forces, who currently use ink or paint to mark landing lines that can't be seen through dust or clouds. The particles could also help distinguish friendly forces from adversaries in combat, detect disturbed soil as part of perimeter security and provide a better alternative to tracking of assets, objects and targets.

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In addition to being the brightest of its type, production of the particle is scalable and affordable, according to the company.

BEHIND THE TECHNOLOGY

Traditional luminescent materials aren't bright enough to be used for complex tagging and detection needs. They also tend to be very unstable in daylight and prohibitively expensive for use in field work, which prompted researchers to consider developing these new materials.

Covert tagging with infrared, as a general concept, was attempted several years ago. For example, U.S. soldiers in Iraq were marked with an infrared glowing tag – an American flag – that was visible with standard night-vision goggles. However, within weeks those tags were being sold on eBay. As it turns out, the use of standard infrared reflectors and standard goggles was the problem.

NanoScience Solutions used Air Force SBIR/STTR support – and partnerships with Clarkson University and Tufts University – to advance the technology from a concept to a commercial prototype. It has developed ultra-bright infrared luminescent particles that meet Air Force requirements and are brighter than any other particles that currently exist. Those particles shine infrared light of a special color that can be seen during the day or at night, but only when using special flashlights and goggles.

After use, the particles turn into sand-like grains which are impractical to distinguish from regular sand.

"Even if the particles were replicated by enemy, the developed platform allows us to change the spectral signature of the particles thereby frustrating attempts to duplicate or counterfeit them," said Yuri Liburkin, CEO of NanoScience Solutions. "As a result, we simply would use another special filter attached to night vision goggles that match the spectral signature of our new particles. The tags will again be invisible to potential foes."

Next, a manufacturing process that could be applied to large-batch production of the particles was developed.

COMMERCIALIZATION POTENTIAL

The phenomenon of ultra-brightness has yet to be fully understood and emerges from an overlap between physics and chemistry at the nanoscale. The advancement of ultra-bright luminescent particles could impact a variety of industries.

NanoScience Solutions is currently looking to test the new particles in the field to generate military sales and is working to apply the particles for different applications, including biomedical imaging and the early detection of cracks in metal construction.

"The technology is a real breakthrough. Its cost is negligible compared to the nearest rival particles, for example, quantum dots," Liburkin said. "The developed particles can be used as pigments in paints, sprays, crayons, markers, etc."



A sign made with particles developed by NanoScience Solutions (left) is invisible to the naked eye, but can be seen (right) using special goggles. (Photo courtesy of NanoScience Solutions)



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