



Material Stops Cosmic Rays

Compound can reduce radiation-induced computer memory errors, parched skin.

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An MDA-funded company is marketing a material that can reduce computer memory errors, prevent cable and wire deterioration, and even minimize skin damage caused by cosmic radiation.

The material, developed by Hybrid Plastics, Inc. (Hattiesburg, MS), provides a lightweight, inexpensive, and highly deployable means to deter radiation.

Hybrid Plastics' patented NeuShield® technology is available in several forms to serve a user's needs: lightweight plastic caps, glue sticks, duct tape, and mascara.

MDA funded Hybrid Plastics' NeuShield technologies with SBIR contracts in 2004 and 2005 to develop a product that could shield computer memory chips from thermal neutron and x-ray damage.

When the first SBIR contract was awarded, Hybrid Plastics already had in-hand the core NeuShield technology, and the company was actively marketing it. The technology, in fact, had been successfully tested on Space Shuttle science missions. The SBIR contracts allowed the company to enhance its product to create additional variants of the material for new applications.

Hybrid Plastics creates the NeuShield material by first inserting metallic atoms such as gadolinium into hollow, nanoscopic chemical "cages," made of a compound referred to as POSS, or polyhedral oligomeric silsesquioxanes. POSS reacts with the gadolinium and becomes a natural agent to attract and eliminate thermal neutrons and x-rays. The company then adds these gadolinium-filled POSS cages into conventional plastics, allowing several products to be manufactured for various applications.

Currently the company's most marketable product is a POSS-based plastic chip-cap that easily fits over a computer chip—whether in personal computers or other electronic

devices—to reduce the effects of neutron-induced memory upsets. These chip-caps also can reduce the threat of such memory upsets in x-ray equipment used for treating tumors.

Given the nature of the POSS nanonchemical material, not all products formed from it have to be solid in nature like the chip-caps. For example, POSS-based materials can be manufactured in the form of a hot meltable glue stick that would allow for spot applications. The only problem with this form is that a particular application thickness cannot be guaranteed. But another adhesive variant—a radiation-hardened duct tape—offers an alternative for users who need a guaranteed thickness when wrapping wires and cables or interconnects. The radiation-hard duct tape will be most useful on mili-

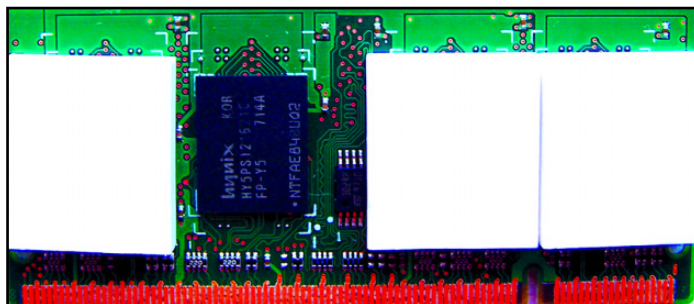
tary equipment and other space electronics housed in composite materials that provide little natural shielding.

Hybrid Plastics is also targeting the cosmetics market. Company scientists have been able to form the POSS nanochemical compound into a liquid that can be dissolved into existing cosmetics such as mascara and facial cream. The POSS mixture minimizes ultraviolet x-ray and cosmic

radiation (thermal neutrons) with the same compound formula used in the company's rad-hard computer chip-caps and duct tape. The POSS cosmetic product also would provide the user a cream that remains optically transparent. The transparent nature of the cream should offer users a more attractive alternative to the milky opaqueness commonly associated with zinc-oxide-based sunscreens.

Hybrid Plastics' NeuShield offers significant advantages over competing products. The product can be deployed virtually anywhere. No retrofitting or additional equipment is required when using NeuShield on any product. NeuShield's

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▲ Hybrid Plastics' rad-hard computer chip-caps (the white squares shown in this photograph) can reduce neutron-induced memory upsets for a fraction of the cost of off-the-shelf rad-hard chips.

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closest competitor provides only x-ray shielding, not both x-ray and thermal-neutron shielding, according to company President and CEO Joe Lichtenhan.

The product is also affordable. NeuShield caps—Hybrid Plastics' leading seller—cost \$3 each for less than 30 caps, and as little as 88 cents each for bulk orders of more than 40,000. That price represents only a tiny fraction of the total cost for off-the-shelf rad-hard chips also used for mitigating radiation effects. Such chips can cost between \$20,000 and \$100,000.

Application performance, which Lichtenhan readily admits has been a challenge, is something that can only be assessed knowing the type of chip and actual radiation environment in which the product is being tested. But in tests conducted by Hybrid Plastics, 1-millimeter-thick NeuShield caps have shown a 70 percent reduction in thermal neutrons, while the 2-millimeter variant allows a 90 percent reduction. In medical applications, the caps have reduced neutron-induced memory upsets from one every minute to about one every 10 minutes.

This summer, Hybrid Plastics opened a 14,000-square-foot addition to its Hattiesburg facility, allowing the company to produce 500,000 pounds of POSS in one year. By 2009, the company should be producing nearly 2 million pounds of POSS annually, according to Lichtenhan.



▲ Hybrid Plastics' diverse rad-hard product line includes NeuShield chip-caps (shown here), duct tape, glue sticks, medical x-ray shielding, and even mascara.

The company also plans to introduce in the near future a new POSS-related technology in the form of a rad-hard NeuShield paint. This development was spurred on by interest from the nuclear energy community in shielding the walls of power plants that contain certain electronic devices.

Despite Hybrid Plastics' numerous successes, the company still is hampered by customer resistance. Lichtenhan said most people still tend to first consider retrofitting and redesigning circuits and components, without realizing there is a simple, inexpensive solution available in the form of NeuShield.

Hybrid Plastics is now looking for additional strategic partners that will adopt the NeuShield technology and insert it into various platforms in the medical field. For electronics, the company is looking to develop an industry standard for radiation shielding and then pursue cross-licensing agreements. Company officials also are interested in pursuing cross-licensing agreements in the aerospace and cosmetics markets. ✨

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