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Heal Thyself

07.20.2009 | Science, Research Self-healing wire developed at the University of Dayton Research Institute was named today one of the 100 “most technologically significant new products” by the editors of *R&D Magazine*.

The award is the second R&D 100 for Robert Kauffman, a distinguished research chemist at the University of Dayton Research Institute, who developed the wire in response to a fatal aircraft accident where faulty wiring may have contributed to a fuel tank explosion.

Dubbed PATCH — Power Activated Technology for Coating and Healing — by Kauffman, self-healing wire uses electrical current and a simple and inexpensive formula to instantly create a new layer of permanent insulation around an area of exposed metal wire when the wire’s original insulation is breached, typically because of age or wear.

Moments after Kauffman learned of the award, Pinnacle Systems in Beavercreek committed to licensing the technology. Pinnacle is a start-up company that works in electro-optics and electrical interconnect activities, including fiber optics and wire products.

PATCH comes in two forms, both based on polyvinyl alcohol. The first is a water-based liquid, similar to a contact lens solution, that can be misted into hard-to-reach compartments that house bundles of electrical wire, such as in airplanes and cars. “The liquid can be sprayed directly onto wire bundles,” Kauffman said. “If it comes into contact with any live wire with damaged insulation, the electrical current at the breach will transform the spray into an insoluble polymer coating. Any solution not coming into contact with exposed wire will wash away, preventing weight-build up from repair activity.”

The second form is a solid, water-soluble material, much like coatings used on vitamins and pain relief tablets. It’s designed to be built into wiring during manufacture, embedded as an inner layer between the metal wire and its insulation. If the insulation is breached while the wire is live, the PATCH coating — already exposed to electrical current and now exposed to air — draws moisture from the air to chemically transform itself into a permanent repair.

Kauffman developed the PATCH technology with funding from the Federal Aviation Administration after serving as a principal investigator into the 1996 crash of TWA 800, which was brought down by an explosion in the center wing fuel tank. Investigators determined that frayed fuel-sensor wiring likely played a significant role in the explosion.

“Aging aircraft wire is a major challenge to the aerospace industry,” Kauffman said. “Over time, bending, chafing and brittleness cause insulation to wear or break away, which can lead to arcing of the bare copper conductor. The results can range from maintenance headaches to a catastrophic event.”

But locating faulty wiring is a daunting task at best, because much of it is not easily accessible. Commercial aircraft contain miles of wire bundled together, and the ever-increasing amount of wiring being used in today’s computerized vehicles naturally leads to an increased number of intermittent electrical problems from frayed wires, according to Kauffman.

“But you don’t want to be taking apart bundles of wire just to look for a couple of hairline cracks, because you can do a lot more damage to good wires trying to find and fix a bad one. Self-healing wire will not only save time and money, but can also increase safety,” he added.

Joseph D’Angelo, chief technology officer with Pinnacle Systems, said safety is one of the reasons the company is interested in licensing the technology.

“We’re a supplier to the Department of Defense, and we’re looking at using the wire in naval applications, which involve a wet environment, as well as aviation applications, for which the wire was originally developed,” D’Angelo said. “Virtually any industrial application that requires wiring will be of interest to us.”

The technology is featured in “Self-Healing Airplanes,” an article in the August issue of *Air & Space* magazine published by the

Smithsonian Institution.

In 1992, Kauffman won an R&D 100 award for the Remaining Useful Life Evaluation Routine (RULER), a “smart” dipstick used to measure the quality of oils in use in aircraft, automobiles and cooking vats. The RULER, now being sold worldwide by Fluitec, saves money by accurately predicting how much useful life remains in an oil, eliminating the need for routine changes that can mean the premature disposal of still-viable oil.

The 47th annual R&D 100 awards recognize the 100 most technologically significant products introduced into the marketplace over the last year, according to Paul Livingstone, senior editor for *R&D Magazine*. Established in 1963 and international in scope since 1965, the awards are selected by an independent panel of experts, including professional consultants, university faculty and industrial researchers. According to the *R&D* Web site, judges look for products that can “change people’s lives for the better and include a ‘Wow! Factor — products that are so interesting, unusual or clearly superior to existing technology that they make you say ‘Wow!’”

Past R&D 100 award winners include Polacolor film (1963), the flashcube (1965), the automated teller machine (1973), the halogen lamp (1974), the fax machine (1975), the liquid crystal display (1980), the Nicoderm antismoking patch (1992), Taxol anticancer drug (1993) and HDTV (1998).

For a full list of 2009 award winners, visit the related link.

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