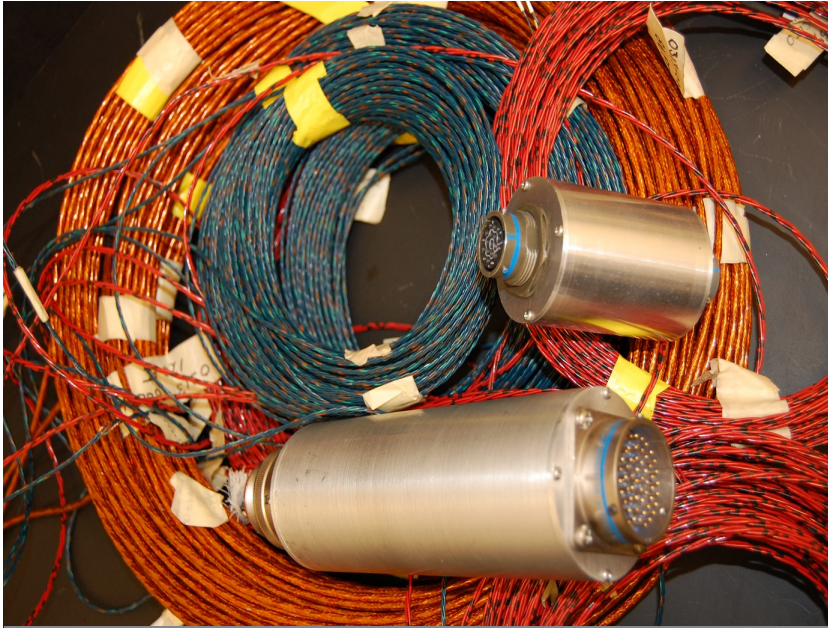


TECHNOLOGY SOLUTION

Electrical and Electronics



Self-Healing Wire Insulation

Microcapsules release healant that repairs minor cuts, nicks, and abrasions

NASA's Kennedy Space Center is seeking commercial partners for licensing or further development of a novel high performance, flexible, low-melt polyimide film with self-healing properties. The self-healing properties of the film are provided by embedded microcapsules containing a solvent soluble polyimide. When cut or otherwise damaged, these capsules release their contents which dissolve and heal the damaged area.

Aerospace and ground vehicles often contain miles of high performance electrical wire insulation which are prone to damage from abrasion and cuts during vehicle operation and maintenance. Large portions of this wire are often buried within the vehicle framework, making it very difficult and time consuming to locate and repair damage. Incorporation of a self-healing capability in the insulation of this wire would provide self-repair of minor nicks, cuts, and abrasions without maintainer intervention and help reduce the danger of electrical shorts that could lead to sparking and fires.

BENEFITS

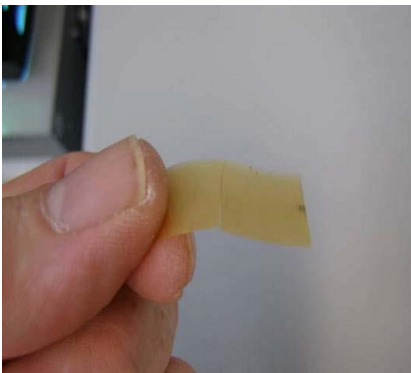
- Reduced Maintenance - Self-healing of minor cuts, nicks, and abrasions on wire insulation can substantially reduce the need to perform inspection, troubleshooting, repair, and/or replacement of damaged wiring.
- Reduced Cost - Installation of wire with self-healing insulation can greatly reduce the cost of materials and labor required for the repair or replacement of damaged wiring.
- Improved Safety - Self-healing capability in wire insulation helps prevent shorts which can lead to sparking and conditions conducive to fires.



THE TECHNOLOGY

Insulation is necessary on electrical wires in order to protect electrical systems from shorting. In high voltage systems such shorting can lead to sparking and fires. Many lives have been lost due to electrical wire insulation failure. Many man hours are also expended in the repair and inspection of electrical wiring in order to attempt to prevent wire failure. Wire insulation with a built in "self-healing" capability would greatly improve the safety of systems containing electrical wiring. Such insulation would require far less inspection and repair time over the lifetime of the system.

Polyimides such as Kapton are an integral part of high performance electrical wire insulation. Traditional polyimides are very inert to solvents and do not melt. A new set of polyimides, developed for use as films for the manual repair of high performance electrical wire insulation, have a low melting point and can be dissolved in special solvents. These properties can be taken advantage of in self-healing polyimide films. Microcapsules containing a solvent soluble polyimide are prepared using industry standard inter-facial or in situ polymerization techniques. These capsules are then incorporated into a low melt polyimide film for use as either a primary electrical wire insulation or as one of several layers of a composite wire insulation. The low melt polyimide film substrate in which the microcapsules are incorporated has good solubility with the solvent used to dissolve the polyimide which makes up the fluid inside the microcapsule. Such a capsule filled insulation, when cut or otherwise damaged, will result in the release of the capsule contents into the cut or damage area. The solvent then dissolves a small amount of the surrounding polyimide insulation but will also begin the process of evaporation. The combination of these two processes allows for excellent intermingling of the healant and the surrounding substrate, resulting in a repair with superior bonding and physical properties.



UV Cured Microencapsulated Healant

More Information

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NP-2015-02-1346-HQ

APPLICATIONS

The technology has several potential applications:

- Aerospace (Aircraft, Helicopters, Rockets, etc.)
- Defense (Missiles, Ground Vehicles, Ships, Submarines, Unmanned Aerial Vehicles, etc.)
- Automotive

PUBLICATIONS

Patent No: 8,119,238; 10,174,198

technology.nasa.gov

NASA's Technology Transfer Program pursues the widest possible applications of agency technology to benefit US citizens. Through partnerships and licensing agreements with industry, the program ensures that NASA's investments in pioneering research find secondary uses that benefit the economy, create jobs, and improve quality of life.

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