



NASA STTR 2005 Phase I Solicitation

T6.01 Self-Healing Repair Technologies

Lead Center: KSC

It is highly desirable to develop technologies for polymeric materials used in electrical wire insulation that have the ability to self-heal. One example of self-healing is the repair process for composite materials, which uses the stress induced by a microfissure to rupture microcapsules of repair materials. In this system, a monomer is microencapsulated and then dispersed along with a catalyst. Once the microcapsules rupture, the monomer is polymerized by the dispersed catalyst and the microfissure is filled. Applications for self-healing processes for materials can be found in areas where failures could result in catastrophic consequences. For example, failure of structural members in spacecraft or aircraft; failure of electrical wire insulation materials used in spacecraft, aircraft, or buildings; or failure of polymer membranes used in critical separations in space exploration or medical devices. The key to any self-healing process is to use the change that occurs during the onset of the failure to initiate the repair process. This change could be the result of an impact to the insulation or the beginning of the electrical breakdown of the insulation. What is required would be an action that provided sufficient energy to start a second reaction or process that ultimately produced and/or bonded the repair material to the damaged insulation.

Wire insulation failure is considered a major problem on spacecraft and proposals should support concepts to develop self-healing technologies that have the ability to repair damaged Kapton or Teflon wire insulation. Of particular importance will be the methods needed to induce the self-repair process in wire insulation that has been manufactured. It is important to recognize the impact of the manufacturing process used to produce the insulated wire on the final product. These methods must produce a flexible, watertight seal over the damaged area. The physical and chemical properties of the final repair material should be similar to the initial insulating materials.

Proposals are also sought for innovative technologies and technology concepts in combining or bonding self-healing materials to conductor materials for an integrated, advanced, next-generation wiring system. Technologies for advancing conductor materials to allow for this integrated system should be considered since this is a topic area of concern in the Human and Robotic Technology Program.