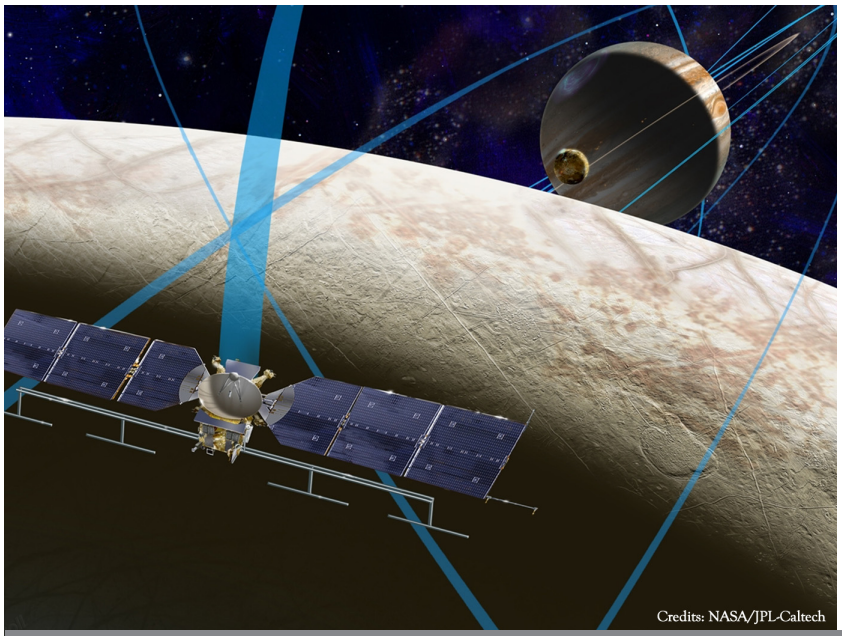


National Aeronautics and Space Administration

TECHNOLOGY SOLUTION

Materials and Coatings

Atomic Number (Z)-Grade Radiation Shields from Fiber Metal Laminates

Shapeable radiation shields

NASA Langley Research Center has developed a shapeable radiation shield made from fiber metal laminates. The technology was developed based on a need for better performing shielding of sensitive spacecraft electronics. Beyond spacecraft electronics, the invention has uses for radiation protective clothing, radioactive fluid piping shields, nuclear reactor shields, and other applications.

BENEFITS

- Flexible, moldable, and can be made for custom, hard-to-shield locations
- Less weight than traditional radiation shielding for electrons and x-rays
- Shield can be integrated with resins to provide easy adhesion

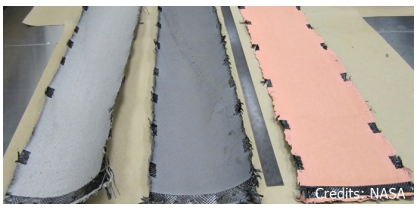
APPLICATIONS

The technology has several potential applications:

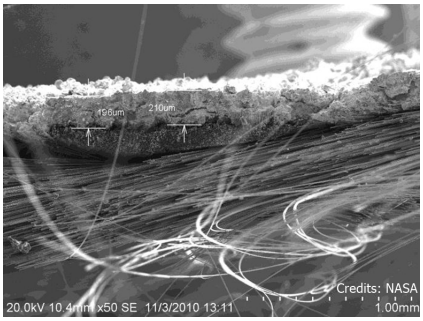
- Radiation protection for electronic instrumentation
- Nuclear reactor shields
- Radioactive fluid piping shields
- Radiation protection clothing
- Spacecraft and satellite shielding

THE TECHNOLOGY

This technology is a flexible, lighter weight radiation shield made from hybrid carbon/metal fabric and based on the Z-grading method of layering metal materials of differing atomic numbers to provide radiation protection for protons, electrons, and x-rays. To create this material, a high density metal is plasma spray-coated to carbon fiber. Another metal with less density is then plasma spray-coated, followed by another, and so on, until the material with the appropriate shielding properties is formed. Resins can be added to the material to provide structural adhesion, reducing the need for mechanical bonding. This material is amenable to molding and could be used to build custom radiation shielding to protect cabling and electronics in situations where traditional metal shielding is difficult to place.



Images of titanium, tantalum, and copper carbon fiber fabrics. Laminates can be made out of autoclave with vacuum assisted resin transfer molding (VARTM).



SEM image of Rf Plasma Spray Ta on IM7 carbon fabric.

PUBLICATIONS

Patent No: 10,039,217; 11,076,516; 10,919,650; 8,661,653; 11,724,834

NASA Shields 1: A Radiation Shielding Experiment Developed with Radiation Modeling. Dr. Larry Thoms
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> <
> YouTube https://youtu.be/oHA8j5bpFcU?si=7koSPeoGzVvYB3FK.

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LAR-17919-2, LAR-17919-3, LAR-18586-1-CON, LAR-17919-1, LAR-18586-2-CON, LAR-TOPS-201