National Aeronautics and Space Administration

NASA

TECHNOLOGY SOLUTION

Materials and Coatings

Flexible Lightweight Radiation Shielding

Method of making thin flexible Z-shielding integrated with common textiles

Lead-filled aprons are currently used for atomic number (Z)-grade radiation shielding in the medical industry to protect personnel from hazardous gamma radiation. These apron garments are made with lead-filled elastomeric sheets encased in polymeric fabrics and are both heavy and bulky to meet necessary shielding requirements. In addition, there are environmental safety concerns surrounding disposal of these garments due to their lead content. An innovator at NASA Langley Research Center has developed a novel method for making thin, lightweight radiation shielding that can be sprayed or melted onto common textiles used in clothing such as cotton, nylon, polyester, Nomex and Kevlar. The lead-free shielding is more effective at blocking radiation as compared with similar thicknesses of lead while being up to 25% lighter. The shielding can also be formed into a variety of garments such as shirts, vests, jackets, and pants with significantly greater comfort and conformity than the aprons currently in use.

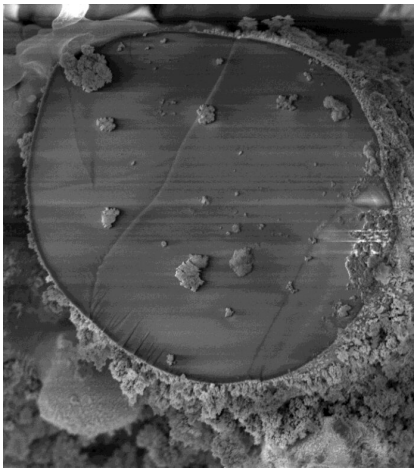
BENEFITS

- Lead-free
- 10 to 25 times greater radiation shielding performance compared to similar thicknesses of lead
- 25% lighter than equivalent thicknesses of lead
- Shielding can be applied to commercial fabrics to create a flexible material that can be shaped and woven into a wide variety of conformable garments and coverings

THE TECHNOLOGY

The thin, lightweight radiation shielding is comprised of a low Z/high Z/low Z layered structure wherein the low Z layer is composed of titanium and the high Z layer is composed of either tantalum or antimony. Modelling of radiation shielding performance from a Cobalt 57 source shows a 10 times reduction in gamma radiation when using tantalum and a 25 times reduction when using antimony as compared with a single layer of lead. In addition, the Z-shielding is 25% lighter than a single lead layer with the same thickness (0.35-0.36 mm). The direct textile spraying innovation outlined by this invention enables the ability to shape this shielding into garments via the sewing of metal coated fibers. The refractory metal shielding can be added onto a variety of commodity-based fabrics including glass fabrics.

Image of Ta/Ti glass fiber fabric samples.



Cross-sectional SEM image of Ta/Ti coated glass fiber.

APPLICATIONS

The technology has several potential applications:

- Medical: personal protective equipment for personnel in hospital radiation environments
- Medical: radiation shielding for hospital facilities and equipment
- Electronics: radiation protection for electronic instrumentation
- Aerospace: shielding for spacecraft, satellites, and personnel

PUBLICATIONS

Patent Pending

technology.nasa.gov

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More Information

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