New Electromagnetic Interference Shielding Material Demonstrated

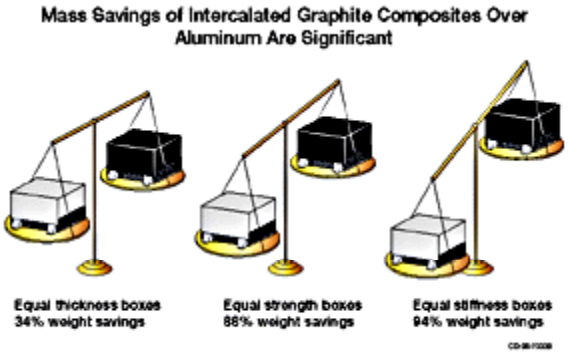
A demonstration electromagnetic interference (EMI) shielding cover that has a potential mass savings in excess of 80 percent over conventional aluminum has been fabricated and tested. It was the culmination of a 3-yr effort involving Hughes Space and Communications (Los Angeles), Applied Sciences, Inc. (Cedarville, Ohio), and the NASA Lewis Research Center. The cover was fabricated from a composite of polycyanate ester resin and graphite fibers that had been chemically modified by intercalation to enhance their electrical conductivity.

Intercalated graphite fibers are made by diffusing bromine between the carbon layers of the graphite fibers. The resulting material has mechanical and thermal characteristics that are virtually identical to pristine graphite fibers, but with a fivefold greater electrical conductivity. Although intercalates are available which increase the conductivity more, bromine forms intercalation compounds that are stable at high vacuum, high humidity, and temperatures as high as 200 °C. This enables the fibers to be handled at ambient conditions, and the resin to be cured at standard temperatures without decomposition. Flight tests on the space shuttle have confirmed the environmental stability of these fibers, and the enhancement in electrical conductivity makes composites made with these fibers more suitable for electromagnetic inference shielding applications.

The intercalated graphite technology was developed at NASA Lewis Research Center and transferred to Applied Sciences through a Space Act Agreement. With NASA's technical guidance, Applied Sciences intercalated the graphite fibers and then sent them to Hughes where, under a second Space Act Agreement, they were formed into composites with RS-3, a low-outgassing polycyanate ester resin. Three-foot-square composite sheets were fabricated along with a five-sided EMI shielding box (3 by 3 by 12 in.) with a standard mounting flange.

The shielding effectiveness of the composite box was tested over a frequency range of 100 kHz to 1 GHz. The box required no special treatment where it met the aluminum flange in order to electrically seal it. The shielding performance was acceptable over the entire frequency range, with the minimum shielding being 35 dB of the incident voltage (70 dB of incident power) in the 2- to 30-MHz range.

The potential for weight savings with this technology depends on which property of the cover is the limiting factor. If equal thickness covers are used, then the saving is about 34 percent because of the lower density of the composite. If shield strength is the limiting factor, then the superior strength of the composite allows the savings to be increased to about 88 percent. If stiffness is the limiting factor, then the savings can be as high as 94 percent.



Mass savings of intercalated graphite composites over aluminum are significant.

Lewis contact: Dr. James R. Gaier, (219) 982-5075 (during school year) or (216) 433-6686 (when school not in session), jrg@manchester.edu
Author: Dr. James R. Gaier
Headquarters program office: OSAT