May 1967

Brief 67-10122

NASA TECH BRIEF

Evaluation of High Temperature Stranded Hookup Wire

In the selection of wire and insulation materials for electronic space assemblies, proper consideration must be given to design criteria and end use requirements. Knowledge of the advantages and limitations of these materials will prevent overspecifications and should result in direct cost savings.

To aid in the selection of these materials, tests were performed to determine primary wire characteristics in the areas of tensile strength, flexibility, conductivity, and general workability. Supplementary sampling tests were included to supply additional information usually required by procurement specifications.

The types and sizes of wire evaluated are:

Wire Type	Conductor Composition	A W G Size	Insulation
Silver Shield	Ag/Ni/Cu	22-19/36	Teflon
Fine Silver	Ag	30-19/42	Teflon
44/0111/30-9	Sn/Cu	30-7/38	Kynar/ Polyolefin
Alloy 765	Ag Alloy	30-19/42	Teflon
TRT 20(19)UZ	Sn/Cu	20-19/32	Polyolefin

Note:

Ag/Ni/Cu-Copper is plated with 40 microinches of nickel and 40 microinches of silver overall

Ag -Silver (Fine)

Sn/Cu -Tin coated copper

All wire insulations were applied by extrusion process.

The following is a summary of the test results:

Of the three insulation materials tested, Teflon (TFE) is superior in extremely high temperature applications. The irradiated Kynar polyolefin is sufficient for most high temperature uses and will withstand temperatures well above the normal 100°C applications.

The use of Teflon extruded insulation is limited by the inability of tin coated applications to withstand the Teflon extrusion temperatures which range up to 540°C. In space system applications using Teflon insulated wires, the copper conductors are plated with nickel or silver. The silver plating results in cuprous oxide or "red plague", a condition generally recognized throughout the space industry. The silver over nickel over copper conductor was intended to overcome this corrosive condition, but environmental tests prove the corrosion continues to form and progress. Tin or nickel coatings are not subject to this electrochemical corrosion.

The use of Teflon over pure silver or silver alloy eliminates the formation of red plague and has excellent electrical characteristics. Limitations due to higher costs and availability are the prime restrictions.

The strong bond between polyolefin and the conductor accounts for an increased flex life, a higher corrosion resistance, and, to some degree, less desirable stripability characteristics. Since the conductor has less contact with the outside environment, corrosion activity is reduced considerably. By contrast, Teflon does not bond readily, strips easily, and will permit exposure to corrosive atmospheres.

Note:

Additional details of these evaluation tests are contained in NASA Technical Memorandum, Evaluation of High Temperature Stranded Hook-Up Wire, by Harold J. Moore, Jr. and James H. Donnelly,

(continued overleaf)

NASA TM X-53522, June 21, 1966, which is available from:

Technology Utilization Officer
Marshall Space Flight Center
Huntsville, Alabama 35812
Reference: B67-10122

Patent status:

No patent action is contemplated by NASA.

Source: H. J. Moore, Jr. and J. H. Donnelly (M-FS-2478)