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NASA TECH BRIEF

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Low-Resistivity Homogeneous Elastomers

Electrically-conducting elastomers or plastics ordinarily contain some form of finely divided carbon or imbedded metallic conductors. However, such products are of limited use because they are inhomogeneous; carbon or metallic particles separate from elastomers that are under tension or pressure, and there is a decrease in conductivity.

It has been found that a mixture of polyurethane polyelectrolyte (made from polypropylene glycol) and a soluble, conducting organic compound such as lithium tetracyanoquinodimethan (LiTCNQ) produces a homogeneous elastomer which has a resistivity several orders of magnitude less than the polyelectrolyte alone. Thus, whereas a typical commercially available elastomeric polyurethane has a resistivity of approximately 10^{14} ohm-cm at room temperature, the new elastomer has a resistivity of the order of 5×10^{8} ohm-cm at room temperature and can dissipate an electrostatic charge.

Like most nonmetals, the resistivity of polyurethanes is high and decreases with increasing temperatures, but the new elastomeric material has a novel resistivity dependence on temperature, that is, the resistivity changes dramatically over a narrow temperature range in the vicinity of the glass transition temperature. In one instance, a sample showed a resistivity of about 1.5×10^{12} ohm-cm at −20°C and 1.0×10^{8} ohm-cm at +40°C. The new homogeneous elastomers, with a relatively low resistivity in the rubbery state and an extreme rate of change in resistivity with temperature, may provide the basis for construction of thermal switches and are potential candidates for replacing the polymers currently used in operating-room equipment and clothing, photocopy equipment, manufacture of plastic photographic film, etc.

Reference:

Somoano, R. B., Yen, S. S. and Rembaum, A.: Low Resistivity Elastomers. Polymer Letters, vol. 8, p. 467, 1970.

Note:

Requests for further information may be directed to:

Technology Utilization Officer
NASA Pasadena Office
4800 Oak Grove Drive
Pasadena, California 91103
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Patent status:

NASA has decided not to apply for a patent.

Source: Robert B. Somoano,
Shiao-Ping S. Yen, and Alan Rembaum of
Caltech/JPL
under contract to
NASA Pasadena Office
(NPO-11881)

Category 04