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NASA TECH BRIEF



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Quick Don-DoFF Electrode Pastes

An evaluation of electrode pastes for use with electrocardiographs (EKG) and electroencephalographs (EEG) was made by a group of researchers. This research represented a further effort to obtain highly conductive, drift-free, noninterfering pastes for medical applications.

In the preliminary phase of this study, approximately 300 candidate materials were screened including: (a) natural and synthetic rubber compounds, (b) synthetic rubber, (c) various natural and synthetic rubbers and resins mixed with silver metal powder, (d) silicone resins, (e) conductive gels, and (f) a variety of adhesives. Natural and synthetic rubber compounds were found to be impractical because they could not readily be made conductive and at the same time retain permanent tack. Metal powders such as silver could not be added to rubber compositions without encapsulating the metal. Although salt solution could be added to water emulsions of homopolymers as polyvinyl acetate, they were observed to leave a brittle nontacky film upon drying. In these investigations such fluoroelastomers as Veton were rendered extremely tacky, but they could not be made conductive without the addition of certain organic conductors still in the developmental stage. Silicones as well as the fluorinated elastomers were found to be extremely hydrophobic and would not readily adhere to the skin.

Research for a quick don-doff electrode also included studying the behavior of electrolytes in synthetic resins as well as adhesives derived from natural products. Electrodes based upon polyvinyl acetate, polyvinyl methyl ether, aqueous dispersion of polyisobutylene (butyl rubber), copolymers of vinyl acetate and ethyl hexyl acrylate, sodium alginate, vinyl

plastisols, sodium polyacrylate, pectin gels, comonomers of acrylates and styrene, gelatin, celluloses, starch phosphates, polyvinyl alcohol, acrylics, and many combinations thereof, have been evaluated. The following are among those determined as the most promising: (1) starch phosphate, a vinyl ether polyelectrolyte and a finely divided silica filler; (2) a specific resin, sorbitol, and a siliceous filler; (3) selected glycols; and (4) sodium caseinate solution. The compositions that incorporated certain fillers were found to give the proper thixotropy to the adhesive compositions, but they were observed to dry more readily when exposed to the atmosphere. The evaluation of compositions based upon specific resins investigated disclosed that they gave good body to the gel structure, particularly the pectin gels; the aggressive tack and stringy character of the resins were significantly reduced. In this study, sorbitol was used as a humectant and selected glycols were used to plasticize the adhesive formulas. The lithium ion was used in all materials as the supporting electrolyte in order to make the composition conductive.

The results of screening a large number of formulations having the desired don-doff properties for an electrode paste led to the conclusion that a water soluble or water-dispersible base would be the most favorable. A number of the most promising formulations were prepared and evaluated to provide a base for ultimate refinements and further study. Two of these formulations that were determined to provide such a base were: (1) a series of poly (methyl vinyl ether/maleic anhydride) interpolymers in low to high molecular weights and (2) starch gels of the "gum drop" variety.

(continued overleaf)

Notes:

1. This information may be of interest to researchers concerned with medical research and applications.
2. Requests for further information may be directed to:
Technology Utilization Officer
Manned Spacecraft Center
Houston, Texas 77058
Reference: TSP69-10598

Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

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