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SANDIA SYSTEMATIC DECLASSIFICATION REVIEW

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6. Comments:

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October 15, 1963

Sandia Corporation
P. O. Box 5800
Albuquerque, New Mexico

Attention: Mr. G. O. Thorne, Organization 2641
For: Mr. C. W. Sprague, Organization 1532

Progress Report #1 (Ceramic Phase of I.S.S. Program)

Work has been started on fabricating five inch diameter disks having a double spiral circuit on one side. The work thus far has been done in the following manner:

I. Disks

The disks were cut from one-half inch thick 6061-T6 Aluminum Alloy stock. Disks were then grit blasted prior to plasma arc spraying to clean and roughen the surface.

II. Plasma Arc Spraying

A. Nickel-Aluminide

Nickel-Aluminide powder obtained from the Metco Corporation was used as an interface between the aluminum metal and the alumina coating. Various current settings were tried but difficulty in spraying the powder was encountered each time. The powder did not flow uniformly and did not appear to have good adherence characteristics.

B. Nickel

Nickel was tried as the inner-face material and seemed to do a satisfactory job. The nickel was sprayed on using a current setting of 600 amps. Coatings were applied in various thicknesses of 3, 5, and 7 mils. In this thickness range there was no detectable difference in the adherence of the alumina. All future samples were sprayed with approximately 3 mils of nickel.

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C. Alumina

Three different particle sizes of alumina were tried. The sizes were -325, -500, and -900 mesh alumina. It was found that during the spraying the -900 mesh would not feed into the gun properly. This was also found to be the case with the -500 mesh alumina. The best coatings were obtained using the -325 mesh alumina and a current setting of 600 amps.

III. Surfacing

The samples were surface ground to produce a smooth surface before impregnation of epoxy.

IV. Vacuum Impregnation With Epoxy Resin

A. Sample Preparation

1. Vapor degrease in trichloroethylene.
2. Solvent wipe with Freon TF.
3. Preheat sample to 160°F prior to impregnation.

B. Formulation

100 pbw Shell 828
20 pbw Shell Z Hardener

C. Impregnation

1. Heat Shell 828 to 160°F.
2. Add Shell Z Hardener and mix
3. Evacuate the mix for 2 min. at 0.5 to 3.0 mm mercury absolute.
4. Immerse samples in mix and evacuate for 5 min. at 0.5 to 3 mm mercury.
5. Drain and squeeze off excess material.
6. Cure for 15 hours at 250°F.
7. After impregnation the samples were lightly vapor blasted.

V. Plating

A. Cleaning

1. Immersed in an alkaline cleaner at 150°F for 2 min.
2. Hot water rinse.
3. Immersed in 10% solution of sulfuric acid for 2 min.
4. Hot water rinse.
5. Immersed in 30% hydrochloric acid for 3 min.

B. Electroless Copper

1. Immersed in Shipley Catalyst 6F for 10 min.
2. De-ionized water rinse.
3. Immersed in Shipley Accelerator 19 solution for 6 min.
4. De-ionized water rinse.
5. Immersed in Shipley Cupcait solution for 20 min.
6. De-ionized water rinse.

C. Electroplated Copper

1. 20% fluoboric acid dip.
2. Plated for 35 min. at 30 ASF in a copper fluoborate bath. This plating time will give approximately one mil of copper.
3. De-ionized water rinse.

VI. Photoresist

1. Copper plate was cleaned with pumice and brush.
2. Kodak photo resist was sprayed on copper plate and baked at 150°F for 15 minutes.
3. Negative was placed on part and exposed to carbon arc light for 3.5 min.
4. The image was developed.
5. Etched in ammonium persulfate solution.

VII. Results

The results of the first samples were very promising. The first sample was exposed using a positive so that a tin-lead coating could be applied to the circuit, the conductor paths were 5.9 mils wide and the gaps were 4.9 mils wide. On the next sample made, the dimensions were reversed because a negative was used instead of a positive.

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At the present time all circuits which have been etched showed discontinuities. It was felt that these breakdowns were due to poor contact between the negative and the work piece during exposure.

Future samples will be lapped instead of surface ground. Efforts are also being made to have a vacuum fixture available for use in exposing the circuit.

Very truly yours,

T. F. Murray
Materials Engineer
Department 832-3

TFM:blb

cc: B. C. Kester, D/710
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