MATERIALS NEWS

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THE ELECTRON MICROSCOPE AND MATERIAL STUDIES

How is the surface prepared? Molded? Etched? Lapped? How does the action of the wiper affect the surface? These questions were asked about plastic-base potentiometers used here at TEK. The answers were given by the TEK-made electron microscopes, located in the Chemical Support Lab under the direction of Peter Burke.

The potentiometers are made of a disc of plastic material with a conductive band around the circumference. To form the conductive band, the plastic is impregnated with carbon or graphite. Since the resistance of the band is related to the thickness, the question is—has the potentiometer been overcoated and then lapped to a specified resistance or has it been molded to this specified resistance?

Figure 1 shows the unimpregnated base surface of the potentiometer. Polishing marks are clearly visible. Figure 2 shows the wear from the action of the wiper on the conductive section. Polishing marks, less than 1 micron in width, are also visible here, indicating that the conductor surface was prepared by lapping. Geoffrey Levear of TEK's Plastic Engineering Department says these pictures confirmed their hypothesis and thus eliminated several possible avenues of investigation which otherwise would have been pursued.

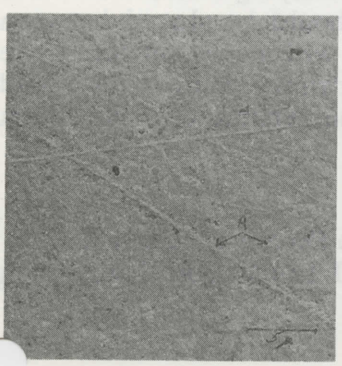

Fig. 1. X 3000

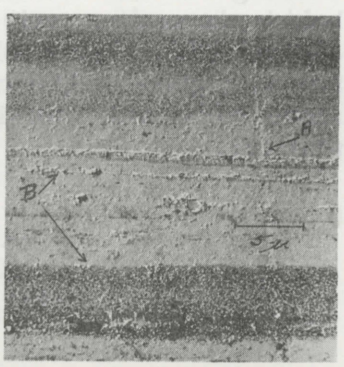

Fig. 2. X 3000

This surface analysis is an example of the use of the electron microscope in material studies.

The investigation of surfaces using the electron microscope can be accomplished only by the use of replicas. These are carbon films thin enough to permit transmission of an electron beam. They are shadowed with a heavy metal to give contrast. Such replicas will routinely copy a surface accurately down to .05 micron or less. From them, electron micrographs are provided which will show, on any one 8" x 10" photograph, areas covering $5600\mu^2$ (8.9 mil^2) at 3000X magnification to $14.4\mu^2$ (0.22 mil^2) at 60,000X. These magnifications permit the study of surface details not resolvable in the light microscope but details which are nevertheless pertinent to the behavior of materials.

-Laura Lusk, Ext 7846
3D Mtrls. and Proc.

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FLAMMABILITY TEST OF PLASTICS

The following materials have been rated noncombustible per C.S.A.* tests conducted by TEKTRONIX, Inc. on 1/8 inch thick test panels.

1. ABS
   Cycolac KJ-20577, White, Marbon Chem.
   Not a TEK item.

2. Modified Polyphenylene Oxide
   Noryl GFN 2-701, Black, General Electric
   TEK P/N 255-0271-00

3. Polycarbonate (20%) Glass Filled
   Thermocomp DF-1004, Grey Cy 0-027, LNP
   TEK P/N 255-0235-00

4. Polycarbonate
   Lexan 2014-701, Black, General Electric
   Not a TEK item.

5. Polypropylene
   Oleform 2056, Avisun Corporation
   Not a TEK item.

6. Polysulfone
   Bakelite P-1720 Natural, Union Carbide
   Not a Tek item.

(cont.)

Several materials were tested per C. S. A. with a spray - on coating applied to the sample. The following sample passed marginally.

1. Polycarbonate
   Merlon M39-1020, Natural, Mobay Chem.
   Not a TEK item.

Coating applied: Crown Type 1001A, from Crown Industrial Products Company.

This product did not form as thick an intumescent coating on flame tested plastic specimens as on a section of cardboard, for the same thickness of coating. The polyethylene and polypropylene specimens were not surface treated, as suggested by the manufacturer. The coating was therefore rather easily removed. (Therefore, before use of this coating, additional tests are recommended such as life tests.)

The following items of flame retardant expandable polystyrene have been tested per C.S.A. and rated non-combustible.

1.	BASF Corp.	Styropore BF-50
2.	Dow Chemical Co.	Pelaspan FR 333M
3.	Sinclair-Koppers Co.	SE 57A

*Canadian Safety Association, refer to issue #2 MATERIALS NEWS.

-Dwane Romine, Ext 7138
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CORNING #89 AND #95 FRIT

Recent studies have shown some of the important parameters that should be considered in defining a sealing cycle when using #89 or #95 devitrifying (crystallizing) frits. One of these parameters, melting and devitrification temperatures, can be identified through the use of differential thermal analysis (DTA). Figure 1 shows the DTA for both frits when heated at a standard rate. Changes in temperature (micro-volts) with respect to a standard (T-61, tabular alumina) is either positive or negative, respectively, indicating an exothermic or endothermic response. When materials melt, heat is absorbed, and the reaction is endothermic. During periods of crystal formation and growth, heat is given off and the reaction is exothermic.

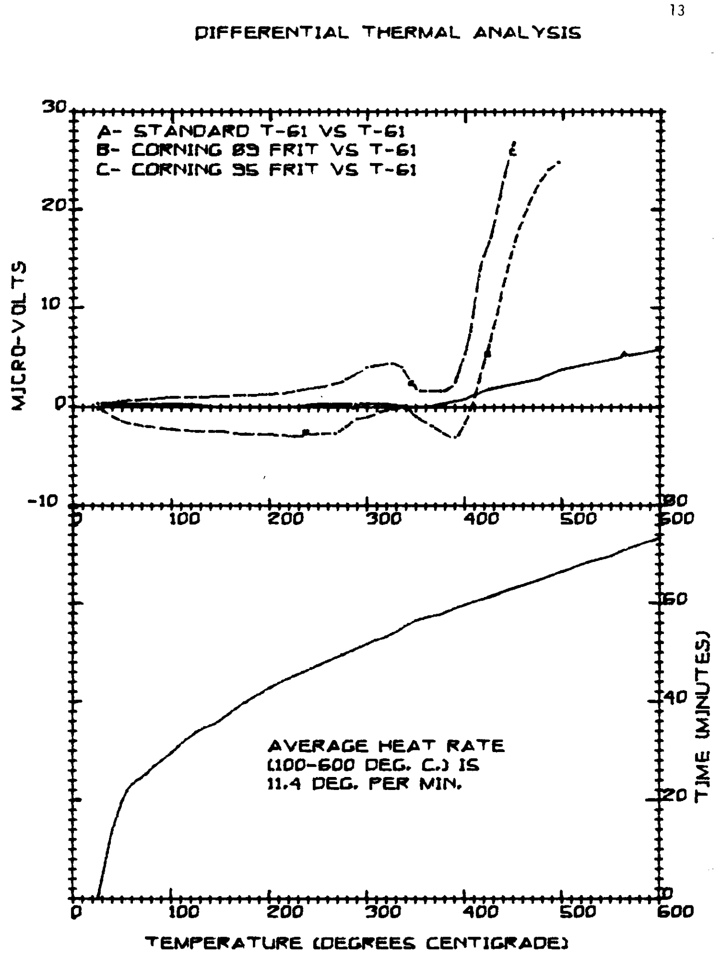

Fig. 1.

When effecting proper seals, the sealant being used must wet the surfaces to be joined. This wetting increases as the viscosity of the glass decreases—melts. The DTA curves indicate that the peak rate of melting (greatest endothermic response) for #89 and #95 frits is between 350 and 390 °C. Above 390°C a strong exotherm indicates devitrification. Therefore, in order to effect the best seal using Corning #89 and #95 devitrifying frits, a thermal hold in the sealing cycle should be placed between 350 and 390°C. This hold will allow wetting of the frit with glass and/or ceramic, while a final hold above 390°C will, with time, enable devitrification to occur.

-Ron Petersen, Ext 6310
CRT Production Engineering

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