MATERIALS NEWS

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INTRODUCTION

A group of us who work in the Materials Science field here at *TEK* have been discussing the need for a better distribution of information regarding the field of materials. We see many interesting and useful developments occurring in certain areas, but people in other parts of the company often are not aware of these developments.

The purpose of this newsletter is to promote better information distribution about materials. Its aim is to be specific and always point the information towards our needs and applications here at Tektronix. We hope to cover such items as: availability and usefulness of special metals, ceramics and plastics; articles on electrical properties of materials that are not clearly defined in vendor literature; articles on desired information, services available here at *TEK*, reference material, etc; notices of seminars that are of general interest; brief reports on new developments in the field, and other items which may be of interest to the technical community.

It is hoped that this first issue will give a more specific idea of what is intended and spark a note of interest in those who may be concerned about this developing field of technology.

Any and all comments are heartily solicited. The only way to make this an effective media is to receive feedback from the readers as to their specific needs and interests.

If you wish to receive this newsletter, please contact the above address. Any suggestions or comments please send to: Tom Currans, Ext. 362, 50-348.

CERAMICS

Metallic Electrical Lead-Throughs for Ceramic CRTs

By Ronald O. Petersen, Extension 6330

In response to the apparent difficulties (e.g., leakers, poor electrical conductivity), associated with the present ceramic lead-through (silver-walled hole plugged with frit), Ceramics has developed a metallic electrical lead-through that can be applied by machine, is inexpensive and provides a hermetic seal with electrical resistance of one ohm. The lead-through is coated with gold on the inside, eliminating the present "Dag" requirement to prevent internal charging. The system developed is as follows:

A Sylmet #4 alloy tubular rivet which has been preoxidized can be glazed and stacked in place (Fig. #1). Gold resinate is applied over the top and the system is fired at 600 °C to produce a tight, strong lead-through of approximately one ohm resistance, that can be contacted externally with a male type pin or a silver band. The final result, as shown schematically, is operational in a 564 storage tube now undergoing life tests.

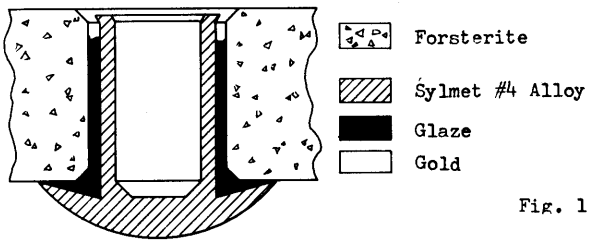

Fig. 1

Forsterite Ceramics - Starting Material for CRT's

"Forsterite" is the minerologic name for the orthorhombic compound $2MgO \cdot SiO_2$, and following the usual ceramic practice of naming formulations after their principal constituent, is the name given to the material of which our funnels are made. Forsterite barely deserves the distinction of naming the material, however, because the other crystalline phases of periclase (MgO) and spinel ($MgO \cdot Al_2O_3$) as well as a variable-composition glassy phase are present in what is actually a forsterite porcelain.

Funnels are shaped by isostatically pressing a free-flowing powdered mixture of periclase, talc, aluminum oxide, dolomite, fluxing material and plastic binder around a machined, aluminum mandrel. The funnels are transformed by heat at 1200 °C to yield a hard, strong, vacuum-tight CRT envelope of the proper dimensions.

Some typical physical properties of the material are:

Fracture Strength:	17,000 psi
Coeff of Thermal Expansion	9.7×10^{-6}/°C (50-550°C)
Dielectric Constant at 1 KC	6.3 (20 °C)
Dielectric Strength:	153 volts/mil
Dissipation factor at 1 KC	5.4×10^{-3} (20 °C)

Ceramic funnels using the powder forming technique offer the tube designer the rather unique advantage of shape flexibility. New or altered shapes can be produced relatively easily without extensive tooling or process changes; thus new ideas can be quickly transformed into a working tube. Moreover, machining of holes, bosses, etc., can easily be carried out in the unfired state.

The ceramic funnel promises to grow in importance at *TEK* and deserves a wider awareness of advantages and drawbacks. We hope in further articles to help remove some of the "mystery" from forsterite.

Jerry E. Turnbaugh - Ceramics Engineering, Ext. 6330

JOINING TECHNOLOGY

Inertia Welding

A refined process of friction welding developed by the Caterpillar Tractor Co. Unique in that it produces solid state bonds in either ferrous or dissimilar combinations. Process limited to parts that will support the thrust and radial loads - one side which would lend to circular geometry. Minimum size of .098 diameter seems to be a limiting factor at the present state of the art. (American Machinist - Oct. 7, 1968, Page 113.)

From Jewelry to Electronics

Would you believe a titanium tie tack pin could be percussively welded to an aluminum panel for a means of attachment (e.g., like a stud)? Or a nickel tie tack percussively welded to a flat manginin resistor for a solder connection post? For further information: Basil Gilman, Materials Application Group, Ext. 7133.

PLATING

Marbon E. P. 3510 Grey Plating Grade A.B.S.

Plated plastic used in medium strength, medium temperature applications. Main applications are for electrical grounding, R.F.I. Shielding, asthetics, and reducing weight. *TEK* parts now in use are P6046 probe and compensation unit bodies, P6049 compensation unit body, light divider readout on the 3T2, light divider spacer on the 3A5, pot cups for the 576, and light spacer dividers for the L03 and M01. Typical properties are:

Property	Test Method ASTM	Unplated (PSI)	Plated (PSI)
Tensile Strgth 73 °F	D-638-64T	5,900	6,900
Tensile Mod 73 °F	D-638-64T	310,000	620,000
Flexural Mod 73 °F 1/8 X 1 X 4 Bar	D-790-66	330,000	910,000
Flexural Yield Strgth, 1/8 X 1" X 4	D-790-66	9,700	12,100
Izod Impact Strgth, Notched 73 °F	D-256-56	5.0	6.0
Deflection Temp 1/2 X 1/2 X 5"Bar			
Unannealed 246 PSI	D-648-56	192°F	214°F
66 PSI		209°F	270°F

Plated E.P. 3510 A.B.S. does pass *TEK*'s -55 °C to 75 °C thermocycle test.

The plastic can be plated with a wide variety of metals.

For further information: Dennis Kuhnle, Electrochem - Ext. 7802.

Bright Tin

Electrochem is plating bright tin plate on a production basis.

Advantages:

- Good solderability
- Corrosion Resistant
- Soft
- Ductile - good flexibility without cracking.
- Better plate distribution than nickel by a factor of 2 to 1

Disadvantages:

- Poor abrasion resistance

Bright tin is being used on:

Crystal Holder: 3L5, 352-0130-01, steel base, 0.5 mil tin

New Generation:

Front and Rear Castings:

Aluminum base, .3 mil satin nickel, .5 mil tin

Plug-in Castings:

Aluminum base, .3 mil satin nickel, .5 mil tin

Cover Line, Voltage Selector, M01:

Aluminum base, 0.5 mil nickel, 0.5 mil tin

Guide, Plug-in (M01):

Aluminum base, 0.3 mil nickel, 0.5 mil tin

Dial Housing (491):

Aluminum casting, .2 mil electroless nickel, .3 mil tin

Chem Milled Parts:

Approximately 10 chem milled parts are being tin plated with 0.3 mil tin

Tentative Plate Call Out:

Aluminum:	0.3 mil min. nickel, 0.5 mil min. tin
Brass:	0.2 mil min. copper, 0.3 mil min. tin
Be-Cu:	0.3 mil min. tin
Steel:	0.8 mil min. tin
Zinc:	0.2 mil min. copper, 0.3 mil min. tin

A *TEK* standard will be written. For further information contact Don Swickard - Electrochem, Ext. 7830

CASTING

The prototype plaster casting area in the PE Model Shop has been working on techniques for casting commercial aluminum alloy #380.

The results to date indicate there are some process variables that are not adequately controlled. There is a second problem in producing a smooth as-cast surface that may be platable on heavy sections and finned parts such as a heat sink.

When the techniques are established that eliminate these problems, the plaster casting area should be able to produce prototype parts of #380 with the same degree of success that is currently experienced with #356. Until then plaster castings will continue to be produced using the #356 alloy.

Bill Sharp - Materials Application Group, Ext. 6528

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During a visit to *PARAMOUNT DIE CASTING CORP.* in St. Joe Mich., we saw 8 aluminum die casting machines producing parts of X-ray quality. The parts that had passed this inspection showed no porosity defects on the film which would indicate any porosity present is on a microscopic scale.

This method of inspection and porosity-free castings appear to have possibilities in the area of reducing our plated castings problems.

Bill Sharp - Materials Application Group, Ext. 6528

PLASTICS

A readily available, up-to-date general information reference on plastics has recently become available. It is in the form of a reference issue of Machine Design entitled "Plastic."

This book contains 214 pages of which 103 pages are devoted to basic generic information and dates on most plastics, plus a discussion of selection, design and applications of plastics and plastics processes from the point of view of the design engineer. The remainder of the book is a product directory.

Copies of the book are available to the subscriber to Machine Design magazine. Additional copies may be ordered from the publisher at $2.00 each.

Dale H. Grimes - Materials Lab, Ext. 6556