MATERIALS NEWS

NOT TO BE DUPLICATED NOR CIRCULATED OUTSIDE OF TEKTRONIX, INC.

COMPILED BY PRODUCT RELIABILITY INFORMATION AS A SUPPLEMENT TO **COMPONENT NEWS**

SEND INFORMATION, COMMENTS OR REQUESTS FOR COPIES TO DEL. STA. 50-462, OR CALL EXT. 272.

No. 3 April 15, 1969

INTRODUCTION

In line with the philosophy of Materials News being representative of the Field of Materials Science throughout *TEKTRONIX* and not from any one department, we will publish from time to time editorials by concerned persons. These editorials reflect the views of the author and not necessarily *TEKTRONIX, INC.* or the other contributors to Materials News.

***

EDITORIAL

Many people often wonder what the terms "materials science" and "materials engineering" mean. The idea of lumping all materials into one field comes from the fact that all materials have many things in common. To begin with, they all consist of atoms, and many mechanical, physical and electrical properties are related to the kind and concentration of the atoms present. Also, the atoms in every material are arranged in some kind of molecular or crystalline structure. The kind and perfection of the structure have major effects on materials properties. Furthermore, the microscopic arrangement of the many molecules or crystals making up a material influences properties. Finally, macroscopic features, such as cracks, voids and impurity concentrations or inclusions, affect the behavior of a part or device made of a material.

To understand materials behavior and materials application thoroughly requires a full knowledge of materials at all levels--atomic, molecular, crystalline, microstructural and macrostructural. No one person can understand all materials at all levels, so many people are needed to provide an adequate breadth of understanding. Thus, a unified "systems" approach to materials has developed, bringing together chemists, metallurgists, ceramicists, physicists and engineers to form the new fields of materials science and materials engineering.

-Peter Burke, Ext 7456
Chem Support Laboratory

***

VALUABLE JUNK?

Frequently the cost of reclaiming precious metals from trash is excessive, considering shipping, bookkeeping, and other charges imposed by an outside agency. For sometime, Electrochem Engineering has been developing processes for some of our high-volume trash items. Routinely at present, gold is being recovered as $\geq$ 95% pure metal from rinse water and other gold-bearing aqueous solutions. Silver is being recovered as metallic silver from spent photo-fix solution. Processes for recovery of gold from circuit board scrap and from switch contact scrap have been laboratory tested and production-scale tests are underway. Any valuables in your trash barrel? Call us — perhaps we can make a profitable recovery.

(Cont'd next column)

-Jerry Jacky, Ext 7817
Sam Njoroge, Ext 6598
Electrochemistry

***

CERAMICS

Hybrid Circuits Substrates

Presently, the Hybrid Circuit Engineering group is shifting from 85% alumina (Al_2O_3) substrates to 94% alumina substrates. This is being done to capitalize on the improved properties and stability inherent in a higher alumina system. The reasons for this improvement can be seen when the material system is analyzed.

Basically, alumina ceramics can be conceived of as being a mixture of three phases. These include alumina crystals, glass and pores (voids or entrapped gasses). Overall properties are determined by the relative amount, type (except for the Al_2O_3), size, and distribution of these phases. In general, only the Al_2O_3 phase goes through the process without major change. In addition, its properties are normally well controlled and can be anticipated. Variations in alumina ceramics, then, can often be attributed to changes in the glass or pore phases. Both raw material and process shifts can cause such variations.

The higher alumina content systems frequently exhibit the best stability and characteristics because the major sources of variation have been reduced in relative proportions. That is, the glassy phase has been partially replaced with Al_2O_3, which has superior physical properties to most glasses. Electrical properties do not necessarily follow this trend, as variations in glass composition can result in degradation of electrical properties beyond the beneficial effects of the increase in alumina. Consultation with a materials engineer is advisable when electrical properties are critical.

Alumina ceramics are normally classified by the percentage of crystalline Al_2O_3 added to the basic mixture, (i.e., 85% alumina has 85% by weight crystalline Al_2O_3 added to the basic mix). The system leaves room for a large amount of difference between identically classified alumina ceramics, as those factors most likely to cause variations are not specified.

-Earl Stapleton, Ext 6363
Hybrid Crts Engineering

***

PLATING

"Albaloy" Plate

"Albaloy," an electrodeposited ternary copper-tin-zinc alloy, has been in use at *TEKTRONIX* for several years. Recent development work on bath composition and operation conditions has significantly increased both the process and product reliability. Typical properties of interest include:

Appearance: Dull luster, resembling stainless steel. (i.e., finishes ranging from #2B to #7 using the *ARMCO* SST sample chart.) Like chromium it reproduces the brightness of the underlying metal.

Solderability: Okay for many applications; better than nickel, poorer than tin, silver, gold, or cadmium.

Corrosion Resistance: Excellent over brass, copper, beryllium copper, phos-bronze. A .0002" thick plate protects basis metal through 50 hours salt spray. Decorative value is generally unimpaired after 8 hours salt spray, and frequently unimpaired after 50 hours salt spray. Unsatisfactory on steel except with special underplates and/or surfaces.

Hardness: Quantitative tests are being run. Literature values put it in the same category as tool steel, but these are not confirmed by present test results, which will be available soon.

Abrasion Resistance: Inferior to bright nickel, but better than tin, silver, cadmium.

Electrical contact Resistance: Similar to bright nickel.

Uses: Brass shields and chassis, shafts, fuse clips, circuit-board stand-off nuts, including items requiring a visible pleasing finish. Good throwing power of the plating bath also provides a plate inside of deep recesses and holes and a uniform plate on threads. On parts subjected to flexing, it should be used with caution because it is brittle. It is being tested on aluminum castings, including external feature areas. In this application it is believed albaloy may tarnish less than nickel, resist handling stains and abrasion, and maintain a low electrical contact resistance.

Don Swickard, Ext 7830 Jerry Jacky, Ext 7817
Dennis Kuhnle, Ext 7802 Electrochemistry

***

ELECTROPLATING

Electroforming

Electroformed parts are made by plating on a mandrel. (A die caster would call this a die or mold.) After plating, the mandrel is removed in some manner.

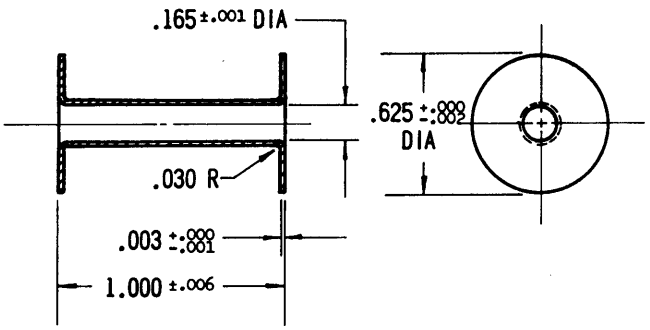
Most electroforms are nickel or copper; although silver, gold and various alloys are also used.

(Cont'd next column)

Advantages:

1. Parts, like wave guides, can be produced with intricate shapes. Some of these cannot be produced any other way.
2. Parts, like stereo record stampers, can be produced with great fidelity.
3. Parts can be made with precise tolerances. Tolerances in the grooves of stereo records are held to 2 millionths of an inch.
4. Parts with intricate designs are reproduced accurately. Surface roughness standards are reproduced this way, with surface finishes varying from 2 to 600 microinches.
5. The process is adaptable to mass automation. *PARKER PEN COMPANY* makes about a half million pen bodies and caps per day on a completely automated machine.
6. Prototype parts can be made by electroforming before hard tooling is made, in much the same manner as chem milling is used.

An attenuator transition electroformed recently for spectrum analyzers looks like this:



Note the wall thickness and ID tolerance of this part, demonstrating how parts can be made by electroforming which are very difficult or impossible to make any other way.

In Electrochem we have electroformed the following:

1. Heat dissipators for triode tubes
2. Electron beam deflectors
3. 500 line/inch mesh
4. Camera shutters
5. Light collimators
6. Light pipes
7. Semiconductor masks
8. Internal square 1/4" ID go-no/go gauges with .3 mil tolerance on ID
9. Bellows
10. Wave guide transitions
11. Probe tips
12. Probe bodies
13. Rolamite bands

For further information contact me.

-Don Swickard, Ext 7830
Electrochem

***