MATERIALS NEWS

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EDITORIAL

The June issue that was devoted to powder metallurgy again illustrated the broad interest that various groups within *TEKTRONIX* have for materials technology in a manufacturing sense. Several welcome comments were received by the editorial staff and as a sequel to the PM topic we offer a PM data page on the back of this issue that can be detached and filed.

In future issues of Materials News, we hope to encourage more would-be authors to try their hand at communicating their technical projects to others in writing. The challenges and advantages of authorship to the individual are obvious in addition to the benefit derived from a wider discussion of materials problems.

-Jerry Turnbaugh, Ext 6330
Ceramics Engineering

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CONFERENCE REPORT

"PROCESS RADIATION IN THE PLASTIC INDUSTRY"

The conference was concerned with using gamma radiation from isotope sources and to process plastic materials. Potentially, radiation, like any other form of energy, can be used to process plastic anywhere heat or chemical catalysts are presently used.

Some of the present limitations on radiation processing are: the large capital equipment cost, equipment utilization because of the high through-put achievable, the few materials which are radiation processable, the proprietary nature of most of the technology, and the phychological attitude toward radiation.

Some present or near-future industrial usages of process radiation are: the production of ethylene oxide — high speed curing of plastic coated wood and painted coiled steel strip — grafting of monomer onto cotton fabric to produce perma-pressed fabrics — cross-linking of electrical cable insulation to produce improved properties — manufacture of heat-shrinkable tubing and the manufacture of stronger, weather-resistant reinforced concrete.

The use of radiation processing should be followed for future applications at *TEK*.

A copy of the conference proceedings is available.

-Dale H. Grimes, Ext 6556
Materials Application

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STRUCTURAL ADHESIVE BONDING

TEKTRONIX began evaluation of structural adhesive bonding in order to produce the 453/454 165M Custom Modification Water Tight Cabinet. Structural failure of the deep drawn can led to the necessity for the change in concept. Appearance and cost were also a definite factor. The box was redesigned to a clam shell type of cover adhesively bonded in place over a welded aluminum frame. The first sample was vibration tested beyond the limits required for the 453 oscilloscope. The box showed no signs of failure but there was internal instrument damage caused by the excessive energy. We have since built three more boxes for Custom Mods using a one-part heat cured paste epoxy, Hi-Flex® 2214 from 3M.

We then assembled a 601/602 Rackmount instrument with Scotch-weld® #42, a dry film from 3M, used in place of the standard spotweld to attach the front frame to the can. This instrument was vibration tested to the damage limits of the electronics and the CRT. After replacing the electronics with dummy weights, the assembly was then vibrated until the spotwelds between the two riveted boxes failed and the rear castings fractured. The assembly was then drop tested from increasing heights until extruded frame was distorted. Through these tests there was no failure of the adhesive bonded joints. This is now a standard production process for the assembly of this unit.

Metals Production is now using three types of adhesives, a one-part heat cured paste epoxy, a two-part room temperature curing paste epoxy, and a heat cured dry film epoxy. The paste epoxies are normally selected for their strength, ability to fill voids and cover large areas. Tape is usually used on close fitting assemblies where cleanliness is important. Each type has its advantages and disadvantages, and each has been chosen for its special characteristics. We are obtaining structural bonds with a minimum tensile shear strength of 3500 PSI and "T" peel strengths from 10 to 70 pounds per inch of width. Conductivity can be provided through nonconductive adhesives by using serrations on one of the bonding surfaces.

With the wide variety of adhesives on the market, an almost unlimited number of bond characteristics can be produced. Depending on the characteristcs required the cost of the adhesive can be significant. Adhesive bonding is another technique available for producing structural elements.

-Jim Wolfe, Ext 7422
Metals Prod Engineering

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PAINTS

Electrocoating

Electrocoating (also called electrodeposition, electrophoretic coating, and anodic hydrocoating) is a process for painting metal objects using an electric field much like electroplating. The object to be painted is immersed in a specially formulated water dispersed paint, usually containing 5 to 15 percent non-volatile matter. The object is then connected to one side of a D.C. electrical source. The metal tank containing the paint usually serves as the other electrode. The paint is formulated so that the paint particles each carry a negative ionic charge. When voltage is applied, the charged particles migrate to the positive electrode (anode) where they are discharged and deposited on the metal. As the coating builds up on one area of the metal object, the electrical resistance increase resulting in decreased current flow to that area. The current then seeks out thinly coated or uncoated areas which have less electrical resistance. This self-limiting property results in a much more uniform film thickness and more complete coverage than would be obtained by conventional methods.

After the coated object is removed from the paint bath, it is spray rinsed with water to remove any undeposited paint. Baking follows with typical cycles of 400°F for 10 minutes or 350°F for 20 minutes.

Advantages of Electrocoating

1. Uniform thickness. (No sags, runs or heavy edges.)
2. Complete coverage of edges, corners, seams and inaccessible areas.
3. Improved corrosion resistance.
4. Elimination of fire and health hazard usually connected with solvent type paints.
5. Low paint waste, operating cost and labor cost.
6. Adaptable to high volume.

Disadvantage of Electrocoating

1. High cost of equipment, such as: D.C. Power Supply, Coating tank and related equipment, Rinse system, Bake oven, Demineralized water supply, and conveyor.
2. Maintaining uniform bath composition is rather complex (similar to a plating solution.) Testing facilities and a competent operator are required.
3. A complete range of colors is not available.
4. Limited to single color-coat and application.

Present Status of Electrocoating at *TEKTRONIX*

A pilot process has been set up in the Metals Chemistry lab which simulates, as closely as possible, a production operation. The results obtained from the pilot process have been very favorable. No corrosion appeared on castings which had been subjected the 50-hour salt spray test, paint coverage was complete and uniform. Film thickness was 0.0005 - 0.001 inches.

This system has been proposed to production for painting of castings.

-Lad Ouzts, Ext 566
Metals Prod Engineer

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FIRED-ON METAL COATINGS FOR CRT FUNNELS

Gold and silver are being presently applied to the CRT envelopes in Ceramics. They are applied in the form of a resinate in the case of the gold and as a paste for both of these metals. In the past, platinum resinate has also been used in place of the gold resinate.

The difference between a paste and a resinate is that the paste is made by mixing a finely divided metal, a suspending medium such as turpineol, a binder to produce a suitable dried material on the substrate (typically ethyl cellulose), and a glass frit to cause the metal to adhere when the system has been fired.

The gold resinate, on the other hand, is a chemical solution made by dissolving gold in aqua regia, then diluting. A solution of venetian turpentine and sulfur is added which produces an organometallic compound of gold, turpentine and sulfur. Because the resinate has a relatively low viscosity, it is easy to apply by brushing and spraying. The pastes are applied by brushing. In either case, the substrate must be clean.

The firing temperature used will be dependent on the metal being fired, but in Ceramics it is usually 700 - 800°C. The firing step is done with an excess of oxygen to prevent the carbon present as organic binders from being reduced to elemental carbon. The presence of elemental carbon causes poor conductivity and adherence and can be detected by the brown color which the carbon imparts to the metal.

The gold surface on the inside of a funnel resulting from the resinate is eight microns thick while the gold paste deposits a 125 micron film and the silver deposits a 250 micron film. Resistance is commonly less than one ohm from wall band to the external silver pad although in some cases a narrow wall band will produce a resistance of two to four ohms.

Until recently, silver paste was used to make the feed-through connection from the gold resinate to the outside of the funnel. However, the silver tended to diffuse through the gold and cause poisoning of the faceplate when it came in contact with the phosphor. To prevent this from happening, gold paste was substituted to make the connection between the gold wall bands on the inside of the funnel and the silver pad on the outside.

At present, methods are being explored to apply these metals more efficiently which may lead to different systems than are now used.

-Bob Yargus, Ext 6352
Ceramic Engineering

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