Nonnekens

T4

February 13, 1956

Trip Report

Destination: Lansdale Tube Company, Lansdale, Pa.
Date of Contact: February 8, 1956
Personnel Present: Mike Sadowsky - Lansdale Tube Co.
Stu Parsons - Lansdale Tube Co.
Don Payne - Lansdale Tube Co.

W. Rublack - General Electric
P. Marapodi - General Electric

Report By: P. F. E. Marapodi

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Purpose of Trip: 1. To obtain information on Philco's "one-shot" screening process.
2. To obtain glass specifications in order to secure precision made plates from Kodak for eventual use as optical masters.

I. Philco's "One-Shot" Screening Process

This title is a misnomer, it does not intend to imply that the entire process for screening any color stripe is accomplished in one procedure. The process is basically a two-step affair - the photo-chemical solution is applied first, then the phosphor is deposited on the photo-chemical base. The title, however, does imply that sufficient phosphor is deposited upon the photo-chemical base in one operation to eliminate any need for a second or third coating of phosphor to get sufficient coverage in the developed line.

A. Screening the facepanel - chronological order of processing stages.

1. Panel inspection.
2. Wash panel and dry.
3. Apply PVA by flow-coating technique.
4. Dry PVA.
5. Leach PVA with anhydrous Solox.
6. Dry
7. Expose
8. Wet exposed PVA with de-ionized water
9. Dust on phosphor
10. Settle phosphor

11. Dry panel
12. Develop with de-ionized water
13. Apply ½% lithium hydroxide solution to panel
14. Dry lithium hydroxide
15. Repeat steps 3 through 14 for the second color stripe to be printed and steps 3 through 12 for the third color stripe to be printed

B. Specific information on various processing stages described in A above.

1. Step A-3 PVA Application
PVA filming solution for all three colors

   a. 600 mls de-ionized water
   b. 290 mls anhydrous Solox
   c. 25 gms of PVA grade 52-22
   d. 2.75 gms of ammonium dichromate

2. Step A-4 Dry PVA

   a. Room temperature at 74°F or less
   b. Relative humidity at 1% or less at 2-1/2 C.F.M.
   c. Dry for 40 minutes

3. Steps A-5 and A-6 Leach with Solox, anhydrous

   a. Apply 100 mls anhydrous solox on panel and flow-coat 5 - 15 minutes.
   b. Drain and dry under conditions of B-2 above except dry for 15 minutes only.

This solox leach softens the PVA film and dissolves some of the ammonium dichromate. What we then have is a density gradient of ammonium dichromate sensitizer in the PVA film going from a lower to higher concentration from the top of the PVA film (facing the neck of the tube) to the bottom. Then, for any set condition of time of exposure and light intensity, the PVA film is polymerized to the same degree - top to bottom. This eliminates the tendency to obtain a too hardened surface if the base of the film is polymerized to the proper degree for adhesion to the glass substrate. A surface which is too hard - overexposure - will lead to a "railroading" effect of the developed phosphor line. Furthermore, the PVA film with the varying density gradient of ammonium dichromate can be polymerized to a "soft" state which will aid in "grabbing" phosphor particles when applied by the dusting technique.

4. Step A-7 Expose

   a. Roughly about 1/4 minutes longer than that used for the slurry technique.

5. Step A-8 Wet exposed PVA with de-ionized water

   a. Spray or flow-coat de-ionized water on panel
   b. Be certain that PVA is uniformly wet and that no water is "running" along panel face when phosphor is ready to be applied.

6. Step A-9 Dust on phosphor

   a. Use spray gun
   b. 30 gms of phosphor each for the red and blue stripe
   c. 15 gms phosphor for the green stripe
   d. Dry phosphor before dusting

7. Step A-10 Settle Phosphor

   a. 3 minutes for each of the red and blue application
   b. 5 minutes for the green phosphor

8. Step A-11 Dry Panel

   a. Dry at conditions in B-2 above except dry for 5 minutes only.

9. Step A-12 Develop with de-ionized water

   a. Develop one minute with de-ionized water.

10. Steps A-13 and A-14 Apply lithium hydroxide to panel

   a. Use 1/2% by weight of lithium hydroxide in de-ionized water
   b. Flow-coat lithium hydroxide on panel for one minute and drain for 1/2 minute. Dry at conditions set in B-2 above.

The application of lithium hydroxide is used to de-sensitize, or harden, the exposed PVA film which is covered with phosphor particles. This, it is reported, will lessen the probability of having the smaller particles of the other phosphors adhering to this developed stripe by virtue of surface chemistry adhesion phenomena.

The lithium hydroxide solution need only be applied after developing the first and second color stripes.

The coating of lithium hydroxide is not washed off after drying. After it has been applied and dried, flow-coat the panel with PVA filming solution preparatory to screening the next stripe.

C. On statements made by Mike Sadowsky pertaining to this method with some comments from the writer.

1. Mike Sadowsky has cautioned me that these processing steps have yet to be finalized, especially steps A-5 to A-8 inclusive, and not too expect perfect results should we try this approach. To date, Don Payne has screened two tubes by this method. I have seen both under vacuum spark excitation and the second tube did contain a good amount of cross-contamination of

green phosphor in the blue line, more so than in the first tube viewed. However, Mike assured me that this problem could be solved eventually and if not, he would be satisfied with this level of cross-contamination. We have obtained screens with a comparable level of cross-contamination but because of our back-scattering problem our upper limit of phosphor contamination has to be considerably less.

2. Mike has tried liquid settling but has discarded this method as being too lengthy a process. PVA developed lines also had a tendency to swell and shift on pour-off when the second and third stripes were liquid settled. Because of the electrolyte in the screening water, the variables of wet and dry phosphor adhesion presented quite a problem at the developing stage.

3. Phosphor Particle Size

   a. There should be virtually no phosphor particles of 3 microns or below.

   b. Once the optimum particle size range has been established, 70 - 90% of the total weight of phosphor received should be in this range.

4. Pilot Operations

   a. Based on his past experience Mike Sadowsky recommends without reservation, that the phosphor slurry technique be employed if time is a pressing factor.

   b. If time is not a limiting factor, then he suggests the dusting technique.

   c. I wholeheartedly agree with Mike, since optical exposure techniques are superior to electron exposure methods (except for obtaining the optical master by the latter approach), we cannot lose by initially using the phosphor slurry technique on the pilot line. This is advisable for two reasons:

      1. We know that we can screen acceptable lines by the slurry technique and we can use panels screened in this manner to solve the problems of aligning the wires in the lightweight removable grille to the printed phosphor lines.

      2. While this is being done we can experiment with the dusting technique, thereby saving much time in the process of solving these two problems simultaneously.

   Then, too, the function of the pilot line is to finalize each and every processing step besides evaluating the equipment itself. Based on past experience with pilot lines, many changes will be made in this one prior to freezing the design for subsequent units.

D. Conclusions

1. I recommend that we continue to use the phosphor slurry technique to:

   a. Help establish parameters and check out our optical masters.

   b. Aid in properly aligning the grille wires to the printed phosphor stripes.

2. I further recommend that we immediately start a group to:

   a. Evaluate Sylvania's dusting technique

   b. Evaluate Philco's dusting technique

   c. Take the best from D-2-a and D-2-b above and combine these with our own PVA formula in an attempt to improve or finalize the dusting process. The main disadvantage to Philco's technique is time and that for Sylvania's are extremely jagged line edges and overlapping, conditions which we can not tolerate.

II. Specifications for Optical Masters

A. Precision Plates

1. Order direct from Eastman Kodak Company, with the following on the order form:

   a. Kodalith Ortho precision plates 5" x 7" x 1/4"

   b. As per Philco drawing specifications A-E-395

   c. Must pass background projection test

   d. Put a small bevel on 5" x 7" x 1/4" plate opposite emulsion side and at the corner where the two precision ground edges meet.

2. Drawing A-E-395 and twelve copies are in our color files.

3. Price from Kodak is $108.13/doz., for a minimum of 10 dozen.

   a. Price is $27.07/doz. for recoating should we return plates for re-processing.

B. Test Plates - 5" x 7" x 0.060"

1. These can be used to establish parameters for obtaining good masters.

2. Emulsion should be the same as that used on the Ortho precision plates, drawing specifications A-E-395.

3. Price, from Kodak, is $3.15 per dozen.

Note: Since both plates described in II-A and II-B above are specially prepared, Kodak will allow us to order them directly from them rather than go to an authorized distributor.

Peter F. E. Marapodi

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CATHODE-RAY TUBE SUB-DEPARTMENT

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