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Experiments to find a manufacturing process for an x-y touch screen. Report on a visit to Polymer-Physik GmbH, Derendingn, Germany, on 26-27 January 1978.

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1. Purpose

The purpose of the visit was to carry out some experiments on a new kind of x-y touch screen, following the principles laid down in a previous report ("A new principle for an x-y touch screen", 16.5.77, SPS/AOP/BS/jf).

The physical construction of the screens was made according to the procedure specified in chapter 4.1 of the above report.

2. Experimental conditions

A nylon mask with a resolution of 200 mesh with the pattern of the x-y screen was prepared for the experiments and a new procedure using electron beam bombardment for an extremely fast (cold) hardening of the thin films (lacquers) was used.

The equipment for these tests was an electron accelerator system, ESH 150. The time for the total hardening of the printed pattern, when scanned by the electron beam, was a few milliseconds. The time to get the screen in and out of the system took only a few seconds.

A more comprehensive description of the electron scanner can be found in Appendix I.

3. The lacquers

The lacquers used were :

UCB 586	insulating, clear
WLAB 68 0012	" , mat

PROTOTYPE EXIST →

RE 609	conductive, gray, medium viscosity, medium grain size, low conductivity.
RÖ 719	conductive, gray, low viscosity, coarce grain size, non milled, medium conductivity.

All manufactured by Herman Wiederhold, Hilden Rhld, Germany.

Classifications are not scientific but given to separate the lacquers the one from the other.

4. Test results

The following can be concluded from the tests :

4.1 Printing techniques

The manufacturing process seems to work. The defects seen on the screens are due to the manual non-reproductive manipulation of the silk screen and printing materials. These defects will automatically disappear when standard techniques for printing are used.

4.2 Conductivity of the lacquer

A lacquer with a much higher conductivity and finer grains should be prepared. This should not be very difficult according to D. Holl. Practical experiments will show what is required.

4.3 Control over the process

The process can be steered and the thickness of the insulating lacquer controlled in such a way that a good antireflective final surface is obtained.

4.4 Touch screen orientation versus mesh orientation

The touch screen line width and line spacing used for the tests (0.2 mm) seems to be the limit for a high resolution printing mask of the type used. It looks like it is possible to obtain an improvement of the line definition by a certain orientation of the mask lines compared to the line direction on the touch screen.

4.5 Electrical contact points

It seems that the uninsulated contact points need to be passed with "sand paper" to get good contact to the conductive lines. It is supposed that this is due to a very thin film of isolating epoxy which is formed by surface strains. This effect will have to be studied in more detail as it can be highly useful in the manufacturing process of the screens. In fact, one could maybe do without the additional insulating layer between the x and y planes.

4.6 Antireflective surface

The highly desired antireflective surface is best obtained when both the insulation layer between the x and y planes and the final surface layer is reduced to a minimum of $\sim$ 3-10 μm. The touch surface now appears to be structured and feels rough as it follows the structure of the wires under it having a thickness of $\sim$ 20 μm.

Such a screen is good if placed near the display device but might smear if placed further away. If a real transparent screen is wanted it is enough to fill the gaps between the wires with lacquer.

The antireflective screen has a second advantage as it is more sensitive and should also give a smaller difference of the sensitivity between the x and y planes.

4.7 Screen support material

Screens were made on normal window glass and plexiglass. In both cases the visual aspect and the hardness of the surface (given by the lacquer) was the same.

The surface hardness and therefore the resistivity to wear and scratches looks good.

The bounding of the paint to the base plate was best for the plexiglass as it looks like the electron beam "dilutes" the plexiglass surface and allows a mixing of lacquer into the plexiglass molecules.

No attempts to optimise parameters were made. Further tests and experience will show whether this is needed.

5. Conclusions

5.1 In general the first results look very promising and a continuation of the work is therefore suggested following the given plan :

5.2 Polymer-Physik will contact the paint factory Wiederhold for a higher conductivity and a finer grain version of the lacquer they produced for these tests.

5.3 We will look for conductive lacquers with a "reactionary bounding substance and monomere for hardening in an electron beam having a viscosity optimised for fine nylon mask printing".

5.4 New tests will be made by Polymer-Physik when the improved lacquers are available. The test plates are sent to CERN for testing.

5.5 CERN will provide the nylon masks on metal frames having the exact dimension of the final touch screen.

5.6 CERN will prepare, hire or buy the supports for doing the printing of the touch screens with the required precision.

6. Acknowledgements

I would like to thank Peter Holl, Werner Zeh and Eberhard Föll for their hospitality and help in performing these tests which hopefully will lead to a new generation of interactive display systems.

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B. Stumpe

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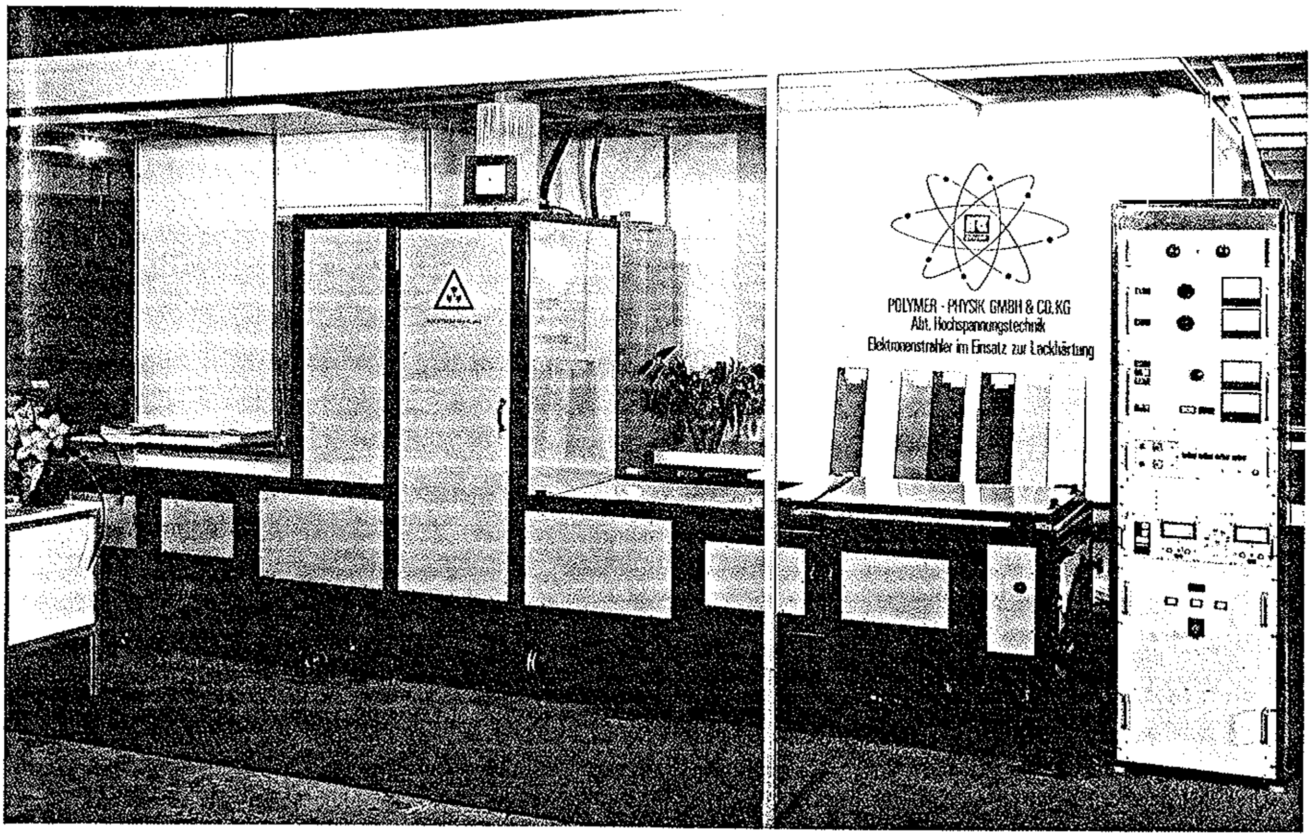

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