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PROGRESS REPORT

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CONDUCTIVE PAINTS

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December 1, 1993- February 28, 1994

Submitted by

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This report covers the work performed from Dec. 1, 1993 through February 28, 1994 under a subcontract from Sayles Enterprises entitled "A Study of Conductive Paints".

I. Paint Hardness

The hardness of the paints as determined in accordance with ASTM Standard D3363-74, a copy of which is attached. Briefly, the samples were held on a flat surface, and pencil lead was placed in contact with paint at a 45° angle with respect to the paint surface. The pencil was then pushed away for about 0.25 inches. The leads used, in order from hard to soft were 6H, 4H, 2H, H, HB, and 2B. The first lead that would not gouge the paint surface to the point where the glass substrate was exposed was recorded.

In order to clarify the results, we will relabel the leads in the following manner:

HARDNESS	LEAD NUMBER	LABEL
Hardest	6H	6
	4H	5
	2H	4
	H	3
	HB	2
Softest	2B	1
	No Lead	0

No recorded lead indicates that even the softest lead gouged the paint through to the glass.

Samples were sprayed onto glass substrates, and air dried or baked for 30 minutes in forming gas at various temperatures where the results are summarized in Table I.

TABLE I

Paint #	SS1001	EW 2002	EW3003	EW 4004
Baking Temp.				
Air Dried	2	0	4	0
150 C	2	0	5	0
300 C	5	5	6	5
450 C	0	1	0	1

It should be noted that three samples of each paint under each condition were tested and the tabulated results represent the average. This data is displayed in graphical form below.

Graph of Hardness vs Baking Temperature

Considering the qualitative nature of the test, the results are extremely useful. All the paints exhibit a maximum hardness at a baking temperature of 300 C, while they all clearly become very soft at a 450 C baking temperature. We believe this shows the binder is beginning to burn off at this temperature. Further, paint EW 3003 is the only paint with reasonable hardness at the low baking temperatures, and is the only one that cannot be scrapped off by the hardest lead.

II. Adhesion to Plastics

No measurable adhesion to delrin, teflon, or nylon was obtained. However, the paints adhere to Plexiglas as seen in the graph below.

In this test the baking temperature was limited to 100 C because of the Plexiglas. Paint EW3003 exhibits a strong adhesion to Plexiglas for air drying and with a 100 C bake, while the other paints adhere well only when baked.

III. Long Term Temperature Exposure, and Thermal Cycling

Samples of each paint have been prepared and will be exposed to elevated temperatures for extended periods of time. The electrical resistivity, hardness, and adhesion will be tested after the exposure to determine the durability, and lifetime of the paint.

Samples will also be rapidly cycled, where the emphasis will be placed on observing cracking, or peeling of the paint.

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