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HANFORD ATOMIC PRODUCTS OPERATION - RICHLAND, WASHINGTON

DOCUMENT NO.

HW-62832

~~COPY 1 MICRO~~

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DATE

November 25, 1959

ISSUING FILE

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TITLE

NON-METALLIC MATERIALS EVALUATION
APRIL - SEPTEMBER 1959

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54-3000-366 (9-59) AEC-GE RICHLAND WASH

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HW-62832

NON-METALLIC MATERIALS EVALUATION

APRIL - SEPTEMBER 1959

By

J. H. Kleinpeter

Process Equipment Development
Chemical Development Operation
Chemical Research and Development
HANFORD LABORATORIES OPERATION

November 25, 1959

HANFORD ATOMIC PRODUCTS OPERATION

RICHLAND WASHINGTON

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NON-METALLIC MATERIALS EVALUATION APRIL - SEPTEMBER 1959

Adhesives

Homalite 1600, a two part adhesive manufactured by the Homalite Corporation, is designed to cement glass to plastics. Samples were prepared by cementing a sheet of glass to a sheet of Lucite. The test consisted of noting the effect of both the liquid and the vapor above the test solution upon the adhesion and transparency of the joint.

Results are tabulated below:

Solution	Effect in Liquid	Effect in Vapor
60% HNO_3	7 days Adhesive dissolving around edges	11 Days Some edge attack
60% HNO_3	43 days Bond strength OK. Adhesive damaged 1/8" in from edge	43 days Lucite badly fogged. Bond OK
50% Caustic Soda	No Visible Effect	No Visible Effect
Carbon Tetrachloride	No Effect on Bond	No Effect on Bond
Recuplex CAX	Slight Bond Damage	No Effect on Bond
Purex HAX	No Effect	No Effect
Trichlorethylene	Lucite Dissolved	Lucite Dissolved
Perchlorethylene	No Effect	No Effect

Tests were at room temperature for 43 days unless otherwise noted.

A test coupon consisting of a piece of Lucite cemented to Plexiglas 5009 with Rohm and Haas P.S. 18 cement was tested in perchlorethylene by static immersion at room temperature for 34 days. There was a slight softening of the adhesive but no appreciable loss of strength. This sample was prepared in the 234-5 shop.

Plastics

Pcx-y-lite, a transparent cast epoxy sheet manufactured by the Homalite Corporation, was tested by static immersion at room temperature to determine its suitability as a glove box panel material. After 94 days the material was unchanged by 50% caustic soda, carbon tetrachloride, trichlorethylene, and perchlorethylene. It darkened slightly in hexone and severely in both Purex HAX and Recuplex CAX. It failed completely in 60% nitric acid after two days.

This product has a tan color when new and has very poor tolerance for the nitric acid bearing solutions. It would be suitable for use in very few locations.

A sample of Teslar, a product of the Dupont Company, has been received for preliminary screening. Teslar is the polymer of vinyl fluoride. After 28 days

static immersion at room temperature this new plastic was completely unaffected by 60% nitric acid, 50% caustic soda, Recuplex CAX, Purex HAX, hexone, carbon tetrachloride, perchlorethylene, trichlorethylene, 1M HF - 2M HNO_3, 1M HCl - 2M HNO_3, 1M HCl - 12M HNO_3, and 48% H.F.

Teslar is said by Dupont to be very resistant to sunlight, and to be strong, flexible and fatigue resistant. Dupont reports that Teslar will withstand boiling solvents such as acetone, benzene, carbon tetrachloride, and methyl ethyl ketone with no visible effect.

Teslar is a thermoplastic and is available only in sheet form at present. It can be heat sealed, metalized, embossed and thermoformed.

This plastic is reported to have the best radiation stability of any fluorine bearing polymer ever tested by the Reactor and Fuels Research and Development Operation. Its maximum radiation tolerance is estimated to be 5×10^8 r.

Teslar has a high melting point. Its zero strength temperature is 570 F. It can be laminated to polymethyl methracrylate sheet. A sample of this laminate is currently being evaluated. This Lucite-Teslar laminate appears, at first look, to be a very likely candidate for glove box and hood panels. The Teslar protected face has much greater chemical and abrasion resistance than does the unprotected Lucite sheet. The presence of the Teslar does not appreciably impair the transparency of the Lucite.

Plexiglas 5009-B, a product of Rohm and Haas, is a transparent plastic sheet suitable for use as glove box and hood panels. It is slightly less chemical resistant than Lucite or Plexiglas but is non-flammable.

There are many places throughout the Hanford Operation where the fire resistant characteristic is of much greater importance than is chemical resistance. Plexiglas 5009 B should be very useful in these locations.

Elastomers

Three elastomeric gaskets for a Snaptite quick connector were tested in Purex HAX to select the best for this service. The neoprene gasket failed immediately. The polyacrylite gasket swelled 14 mils in the first 16 hours. There was little change after that. The gasket had very little physical strength in the swollen condition. It was not useful as a gasket because of this. The third gasket was made of Viton A. It swelled more slowly and less severely than the polyacrylite gasket but still did not have the physical strength required when in the swollen condition.

Gloves

Two experimental gloves submitted by the Charleston Rubber Company were tested for possible use in glove boxes and hoods. These were the regular Neosol neoprene gloves furnished by Charleston for use on our glove boxes but coated with two newly developed proprietary coatings which were intended to increase the solvent resistance of the glove. The two coatings were identified only as Special Experimental Coating A and B. Neither coating increased the

resistance of the base material to 60% nitric acid, carbon tetrachloride, Recuplex CAX, Purex HAX, or hexone.

A pair of vinyl plastisol impregnated cotton gloves manufactured by Jo-Mac Manufacturing Company were tested to determine their suitability for use as a glove box glove. Fingers were cut from one glove and inverted. The pouch thus formed was filled with the test solution. The glove was judged to have failed when the solution appeared on the outside of the sample. After introduction of the test solution the top of the sac was rolled over and sealed with a pinch clamp. The test setup was stored in a small securely closed glass jar to minimize evaporation of the test solution.

After 28 days only a very slight amount of nitric acid had penetrated the glove. With Recuplex CAX the first trace of solution appeared after 5 hours 40 minutes. After 28 days there was no further increase in concentration. Purex HAX penetrated very slightly after 3 hours but the amount had not increased appreciably after 7 days. The glove was judged to have failed after 14 days. The experience was very similar with hexone and carbon tetrachloride except there was no failure even after 28 days.

Fingers from the other glove were immersed in the same solutions so that the effect on the plastisol could be observed. It darkened in 60% nitric acid and Purex HAX, and both darkened and swelled in Recuplex CAX. Neither hexone or carbon tetrachloride had an appreciable effect. Some small pieces chipped off in the hexone but this action did not continue beyond the second day. Test duration was 28 days.