DUROPAL

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CHEMICAL RESISTANCE PROPERTIES

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1.0 INTRODUCTION

Samples of white Duropal laminate sheeting were presented for chemical and thermal resistance testing by Mr Joe Vecchio of M & B Sales, P.O. Box 359 Morley 6062, PH: 272 2555.

Samples the laminate were to be exposed to a number of chemicals and the effects of exposure noted. The chemicals chosen were considered to be those most likely to come into contact with the laminates when used in laboratory environments and those which would be the most aggressive to this particular type of product.

Three series of chemical tests were performed on the laminate. The first two were an examination of the effects of spillage of a chemical onto the laminate. The third was an examination of the effects of prolonged contact. This was accomplished by sample immersion for a defined period of time.

Chemical resistance is generally affected by both temperature and the length of time of chemical contact with the surface. The results of these tests should provide a comprehensive assessment of the chemical resistance afforded by the laminate under extreme conditions.

A thermal resistance tests was also requested. A sample of the laminate was to be exposed to both reflected heat and direct head from the bunsen burner to assess the resistance to heat and flames.

2.0 SPILLAGE/SPLASH TESTS

Each of the test chemicals were "spilled" onto samples of the laminate, left for 10 minutes, and the effects noted. The tests were completed with reagents at room temperature and also at 50DEG. This test sequence should simulate the laminate's resistance to short term exposure of hot and cold reagents. This type of exposure is commonly encountered in accidental spillages where removal and washing is not delayed. The results of these tests are presented in the following tables.

The heat resistance tests performed on the laminate showed no signs of deterioration from reflected heat after two hours. The direct exposure to naked flame was found to char the laminate with the extent of damage very dependent on residence time in the flame. As a general guide, flames or ignited solvents that are extinguished or removed in less than 30 seconds (ie immediately) will not cause the surface to have to be replaced.

Solvents	Observation
Ketone (Acetone)	No effect/deterioration of laminate.
Alcohol (Ethanol)	No effect/deterioration of laminate.
Aromatic (Toluene)	No effect/deterioration of laminate.
Chlorinated (Dichloroethane)	No effect/deterioration of laminate.
Petrol	No effect/deterioration of laminate.
Diesel	No effect/deterioration of laminate.

4.0 EXPOSURE TO REFLECTED AND DIRECT HEAT FROM BUNSEN BURNER

A sample of the laminate was placed under the base of a lit bunsen burner that was placed under a tripod that had been covered with a ceramic mat. Exposure was continued for two hours. This situation is very common in laboratores and should test the laminates resistance to reflected heat. A further sample of laminate was placed directly into the flame of the bunsen and held there for 5 - 30 seconds. Upon completion of these tests the samples were removed and examined.

There were no signs of deterioration of the laminate as a consequence of reflected heat. The sample that was placed directly into the flame for 5 seconds bubbled at the sufrace but did not penetrate the coating. The sample that was held in the flame for 10 seconds showed the beginings of charring on the bubbles that formed. Damaged to surface was evident but not to the extent that would require replacement. The sample that was held in the flame for 30 seconds showed total destruction of the surface and would need replacement.

5.0 SUMMARY

The DUROPAL laminate showed excellent resistance to chemical spillages. The only reagents that significantly deteriorated the laminate were concentrated sulhpuric acid and nitric acid. This was fully expected as no polymer based laminate can withstand these acides. Sulphuric and nitric acids, whether dilute or concentrated, attack the polymer structure that forms the backbone of the laminate and destroys that structure. This effect would occur in all laminates that are chemically similar to this one.

No other reagants, whether dilute or conentrated, caused any serious defects in the laminate. The results of any application, however, of concentrated acids such as nitric and sulphuric are very dependent on residence time and should be avoided if possible.

Organic solvents did not effect the laminate and an excellent resistance to these types of reagents was found.

Reagents	Observation
Bleach (12% avail. chlorine)	No effect/deterioration of laminate.
Brine	No effect/deterioration of laminate.
Sulphuric Acid (Dilute -1M)	Bubbling of surface, loss of shine.
Hydrochloric Acid (Dilute - 1M)	Bubbling, brittle in bubbled areas.
Ammonium Hydroxide (Dilute - 1M)	No effect/deterioration of laminate.
Sodium Hydroxide (Dilute - 1M)	No effect/deterioration of laminate.
Sulphuric Acid (Concentrated)	Severe deterioration, loss of shine, very brittle - crumbles in hand.
Hydrochloric Acid (Concentrated)	Bubbling of surface, loss of shine.
Nitric Acid (Concentrated)	Severe deterioration, discolouration (yellow) bubbling of surface.
Ammonia (Concentrated)	No effect/deterioration of laminate.
Sodium Hydroxide (Concentrated)	No effect/deterioration of laminate.

Solvents	Observation
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Alcohol (Ethanol)	No effect/deterioration of laminate.
Aromatic (Toluene)	No effect/deterioration of laminate.
Chlorinated (Dichloroethane)	No effect/deterioration of laminate.
Petrol	No effect/deterioration of laminate.
Diesel	No effect/deterioration of laminate.

3.0 IMMERSION TESTS

Samples of the laminate were partially immersed in each of the chemicals for a period of one week. The solvents were continually replenished to compensate for losses due to evaporation. When complette, the samples were removed, washed and examined. The results of these tests are presented in the tables below.

Reagents at 50DEG

Reagents	Observation
Bleach (12% avail. chlorine)	No effect/deterioration of laminate.
Brine	No effect/deterioration of laminate.
Sulphuric Acid (Dilute -1M)	No effect/deterioration of laminate.
Hydrochloric Acid (Dilute - 1M)	No effect/deterioration of laminate.
Ammonium Hydroxide (Dilute - 1M)	No effect/deterioration of laminate.
Sodium Hydroxide (Dilute - 1M)	No effect/deterioration of laminate.
Sulphuric Acid (Concentrated)	Discoloured (blackened on contact), Structural damage to surface evident. Chemical reaction has occurred.
Hydrochloric Acid (Concentrated)	No effect/deterioration of laminate.
Nitric Acid (Concentrated)	Severe loss of shine. No visible structural deterioration.
Ammonia (Concentrated)	No effect/deterioration of laminate.
Sodium Hydroxide (Concentrated)	No effect/deterioration of laminate.

Solvents	Observation
Ketone (Acetone)	No effect/deterioration of laminate.
Alcohol (Ethanol)	No effect/deterioration of laminate.
Aromatic (Toluene)	No effect/deterioration of laminate.
Chlorinated (Dichloroethane)	No effect/deterioration of laminate.
Petrol	No effect/deterioration of laminate.
Diesel	No effect/deterioration of laminate.

Reagents at room temperature:

Reagents	Observation
Bleach (12% avail. chlorine)	No effect/deterioration of laminate.
Brine	No effect/deterioration of laminate.
Sulphuric Acid (Dilute -1M)	No effect/deterioration of laminate.
Hydrochloric Acid (Dilute - 1M)	No effect/deterioration of laminate.
Ammonium Hydroxide (Dilute - 1M)	No effect/deterioration of laminate.
Sodium Hydroxide (Dilute - 1M)	No effect/deterioration of laminate.
Sulphuric Acid (Concentrated)	Some discolouration (yellow staining), Slight loss of shine, no visual structural change.
Hydrochloric Acid (Concentrated)	No effect/deterioration of laminate.
Nitric Acid (Concentrated)	Definite loss of shine, yeelow staining, no visible structural deterioration.
Ammonia (Concentrated)	No effect/deterioration of laminate.
Sodium Hydroxide (Concentrated)	No effect/deterioration of laminate.