PolyCo
innovative protective solutions

PRODUCT INFORMATION

PolyConversions, Inc. is pleased to submit the attached report on

The Chemical Resistance of *VR*™ Material

and its Comparison to PVC (Vinyl)

The University of Illinois School of Chemical Sciences compiled the following report.

Their Laboratory test results confirmed the chemical resistance of *VR*™ polyolefin material to industrial concentrations of hydrofluoric, hydrochloric, sulfuric and nitric acids under ambient conditions. The tests demonstrated that *VR* is resistant to these aggressive chemicals and that Protective Wear made from *VR* provides protection against accidental exsposure or direct contact.

These indepentantly performed tests also confirm the successful laboratory chemical resistance tests performed by Delphi Automotive Systems, Kokomo, Indiana when they selected *VR* Protective Wear to replace the PVC (vinyl) wear they had previously been using. Delphi conducted their own tests to qualify and confirm that *VR* would offer protection to employees handling these harsh chemicals in a semi-conductor fabrication environment.

What is particularly noteworthy of these results:

- ☑ The tests were conducted with *VR* exposed to the chemicals over a 24-hour period.
- ☑ None of the *VR* Materials (4, 6, 8 and 12 mil) tested suffered any catastrophic failure (liquid penetraion).
- ☑ The PVC (vinyl) sample suffered catastophic failure when exposed to sulfuric acid.

Under the current ANSI American National Standard governing performance requirements for protective clothing, *VR* is classified as Partial Body Chemical Protective Clothing (with limited spray-tight connections) requiring only liquid spray, liquid penetration resistance and liquid repellency. The ANSI prescribed tests are for much shorter periods of exposure than the tests we conducted at the University at Illinois. In addition, *VR* was tested for relative resistance to vapor transmission. All *VR* materials including PVC had vapor transmission within a short period of time. Only *VR* resisted vapor penetration of sulfuric acid within the 24-hour observation period. However, the threat and risks of employees to vapor only arise in a closed confined environment with continuous chemical contact for extended periods. Under these conditions, gas-tight full body protection with an air supply system or self-contained breathing apparatus is usually required.

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Comparison of the Effect of Exposure to Mineral Acids of Plastic Materials for Protective Clothing.

Introduction.

PolyConversions Inc. submitted several sample of plastic materials for protective aprons, to be compared against a competitors material in terms of resistance to concentrated mineral acids, specifically concentrated HCl (37%), HNO_3 (70%). HF (49%), and H_2SO_4 (98%).

Procedure.

A method was developed to run these tests as safely as possible, using minimal amounts of chemicals.

1) PolyConversions provided a Kimble Brand 100 ml reaction vessel, with a three necked, ground stoppered top. Material to be tested was placed between the bottom and top of the reactor vessel, (photo 01) after the bottom was charged with a small amount of the acid to be used. The flanges of both the top and the bottom part of the reactor were lightly greased, to prevent any possible escape of acid to the outside. After the top was put into place, the apparatus appeared similar to photo 02.

An acid sensitive strip of indicator paper was introduced into the top of the reactor via the side necks and held into place by the matching stoppers. Care was taken that the indicator paper made no contact with the plastic substrate under test. Before the start of the test, the volume above the plastic specimen was purged with a gentle flow of air, to eliminate any possible acid contamination from outside. To begin the test, the apparatus was rotated 180 degrees about it's clamp, (see photos 02, 03) so that the acid contacted the plastic specimen. Periodic observations were made and recorded.

2) For HF testing, a very similar setup was assembled using Teflon digestion vessels normally used in the preparation of ICP sample. The apparatus was the same in principle as the one described above, the same test regime was followed, only the specimens and acid volumes used were smaller, and observations just a bit less "transparent". (See photo 04)

Materials Tested.

PolyConversions supplied samples of their Polywear VR in gauges of 4, 6, 8, and 12 mil. These were compared against a competitive 8 mil PVC product.

Results.

None of the **Polywear VR** materials suffered catastrophic failure (liquid acid break through) when in room temperature contact with the four concentrated acids described above for 24 hours.

HF, HCl and HNO_3 all crossed the plastic barrier in vapor form in relatively short times, only H_2SO_4 did not, the material seemed quite impervious for the 24-hour observation period.

Approximate times to vapor detection, in minutes:

	4mil	**6mil**	**8mil**	**12mil**
HCl	< 10	15	20	120
HNO_3	< 15	15	> 360	~ 240
H_2SO_4		none		
HF	< 5	<60	~ 120	~ 120

And for the competitors material:

HCl	~ 120 to 150 min	
HNO_3	~ 30, 60	see photo sequence 05 to 09
H_2SO_4	~ 140, ~60	see photo sequence, 10 to 16, Catastrophic failure in < 17 hrs (Liquid acid break through)
HF	< 30	

N.B. In a method observed on a video, the test was conducted for relatively short times, using a crude but functional wood frame setup, with relatively large amounts of acid poured directly on top of the material under test. Periodically, litmus paper was brought into contact with the bottom of the substrate, with negative results. Since the test was conducted in a fume hood, that is not surprising, since the air stream quickly removed any vapors that might cross the barrier.

The difference between this and our test indicates some implications for full body protection, where "longtime" exposure in confined spaces would require additional vapor barriers.

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