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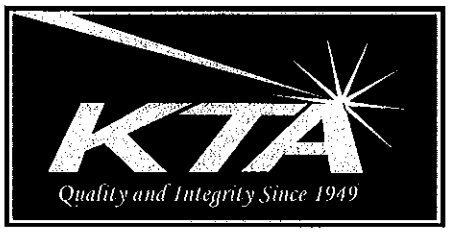

KTA-TATOR, INC.
115 Technology Drive, Pittsburgh, PA 15275

June 8, 2005

Mr. Ashish Dhuldhoya
Polycoat Products
14722 Spring Avenue
Santa Fe Springs, CO 90670

SUBJECT: Results of Physical Testing; KTA Project No. 250065

Dear Mr. Dhuldhoya:

In accordance with Proposal Number PN040466, KTA-Tator, Inc. (KTA) has analyzed samples of Polyeuro® 5502 coating membrane to determine various physical characteristics as outlined below. This report describes the testing procedures employed and contains the results of the testing.

SAMPLES

The following samples were received at the KTA laboratory from Mark Malloy of KTA on March 25, 2005:

Samples KTA-1 through KTA-12 – Twelve (12) 4" x 6" steel panels coated black on one side, labeled "KTA-1 through 12".

Samples KTA-13 and KTA-14 – Two (2) 12" x 16" free films of black coating material, labeled "Sample A" and "Sample B, 2/17/05."

The following samples were received from Polycoat Products on April 25, 2005:

Sample KTA-15 - One pint can Polyeuro 5502 part A and one pint can Polyeuro 5502 part B.

LABORATORY INVESTIGATION

The laboratory investigation consisted of testing samples of Polyeruo 5502 for water vapor permeability, chemical resistance (Atlas cell), water absorption, tensile strength, modulus of elongation and elasticity, compressive strength, impact resistance, tensile adhesion, physical property retention following immersion, impact, thermal cycling, and UV light exposure, shrinkage, thermal expansion, and maximum withstanding temperature. The sample could not

be evaluated for flexural strength due to the highly flexible nature of the material. The results of the testing are provided below.

Water Vapor Permeability

Four disks of the coating material (one designated as the control sample) were cut from the large sheets (KTA-13 & 14) and tested for water vapor permeability using the desiccant method of ASTM-E 96, "Standard Test Methods for Water Vapor Transmission of Materials." Each disk was placed over a 4" diameter dish filled with anhydrous calcium chloride. The disks were secured to the top of the dishes by placing non-permeable wax around the outside perimeter to prevent exposure of the desiccant to the atmosphere. The dishes were then weighed and placed into a temperature/humidity chamber maintained at 32.0°C and 54% relative humidity for thirty-four (34) days. The dishes were weighed separately at various recorded intervals, and the results plotted as weight (grams) versus time (hours). The water vapor permeability was then calculated by using the slope of the graph, as well as thickness and area of the disks. The average permeability in units of perm-inches are reported in Table 1 below. Individual data for each replicate sample is appended.

Table 1 – Water Vapor Permeability Results (Average of 3 Data Points)

Replicate ID	Permeability (perm-inches)
A, B, C	0.00042

Chemical Resistance (Atlas Cell) Testing

Chemical resistance (Atlas cell) testing was performed in accordance with ASTM-C 868, "Test Method for Chemical Resistance of Protective Linings," using a modified Corrocells (a.k.a. "Atlas Cells") due to the size of the submitted samples. The Corrocell ("Atlas Cell") employed was a round glass vessel with one open end as opposed to two open ends. The cell was partially filled with the test liquid (potable water) to create two test phases. The top half of the specimen was subjected to the "vapor phase" of the environment while the lower half was exposed to the "liquid phase." The test duration was 30 days (720 hours). The panel was visually examined every 72 hours for blistering in each phase (vapor and liquid). Blistering was rated after 720 hours of exposure according to ASTM-D 714, "Evaluating Degree of Blistering of Paints." By this method, blisters are rated for both size and frequency on a scale of 10 (none) (no blistering) to 0 (large blisters). Frequency is rated as few (F), medium (M), medium dense (MD), or dense (D). Photographic references in the method depict blister sizes No. 8, No. 6, No. 4, and No. 2, for each of the four frequencies. The chemical resistance testing revealed no blistering in either the liquid or vapor phases.

Water Absorption

The water absorption of the coating material was evaluated in accordance with ASTM C 413, "Standard Test Method for Absorption of Chemical Resistant Mortars, Grouts, and Monolithic Surfacings and Polymer Concretes." The liquid coating was mixed according to the manufacturer's instructions and poured into cylindrical molds. Due to the amount of liquid

coating material provided and short pot life of the coating (2-4 seconds), three replicate determinations were made. The average result of the water absorption determinations was 2.12%.

Tensile and Yield Strength

The tensile and yield strength of the coating material were determined in accordance with ASTM D 882, "Standard Test Method for Tensile Properties of Thin Plastic Sheeting." Five replicate specimens were prepared by cutting straight (1/2" wide) specimens from the free film material. The specimens were tested with a Tinius Olsen Universal Testing Machine at a pull rate of 4.5 inches per minute. The specimens had to be continuously tightened into the apparatus throughout the testing to prevent slipping, thus creating variation in the replicate results. The tensile strength was calculated using the force required to break the specimens and the thickness of each. The yield strength was determined for the associated stress-strain curve of each replicate. The results of the testing are provided in Table 2 below.

Table 2 – Results of Tensile and Yield Strength Testing

Replicate ID	Cross-Section Area (in^2)	Tensile Strength (psi)	Average Tensile Strength	Yield Strength (psi)	Average Yield Strength
A	.055	1640	1870 psi	730	740 psi
B	.056	1770		710	
C	.049	2060		610	
D	.051	2060		880	
E	.056	1840		770	

Modulus of Elongation and Elasticity

The modulus of elongation and elasticity of the coating material was determined in accordance with ASTM D 882. The elongation and elasticity calculations were performed by employing data obtained from the associated stress-strain curve. The resulting values are contained in Table 3, below.

Table 3 – Results of Elongation and Elastic Modulus Determinations

Replicate ID	Elongation (%)	Average Elongation	Elastic Modulus (psi)	Average Elastic Modulus
A	480	440%	180	180 psi
B	430		150	
C	400		130	
D	430		200	
E	450		230	

Compressive Strength

The compressive strength of the material was determined in accordance with ASTM C 579, "Standard Test Method for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings and Polymer Concretes." Cylindrical molds were poured from the liquid coating material (mixed according to the manufacturer's instructions). Because of the amount of material provided, only three replicate determinations were made instead of five. Testing was performed using a Tinius Olsen Universal Testing Machine. The results of the testing are contained in Table 4, below.

Table 4 – Results of Compressive Strength Determinations

Replicate ID	Compressive Strength (psi)	Average Compressive Strength
A	180	180 psi
B	150	
C	130	

Accelerated Weathering (QUV Exposure)

Five panels of each coating type were exposed to accelerated (using UVA 340 lamps) in accordance with ASTM G 154, "Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials," and ASTM D 4587, "Practice for Conducting Tests on Paint and Related Coatings and Materials Using a Fluorescent UV-Condensation Light- and Water-Exposure Apparatus." Exposure consisted to subjecting the coated panels to four hours of UV light at 60 °C, followed by four hours of condensing moisture at 50 °C for a total duration of 24 hours. Following the exposure period, the panels were removed from the apparatus, allowed to dry completely, and evaluated for tensile (pull-off) adhesion (described below).

Thermal Cycling

Resistance to thermal cycling was evaluated by subjecting one coated panel to six hours of oven exposure at 220°F followed by eighteen hours in a freezer at 10°F. The coating was then evaluated for tensile (pull-off) adhesion (described below).

Impact Resistance

The impact resistance of the coating material was evaluated in accordance with ASTM D 2794, "Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)." Weights were dropped from various distances in the forward impact direction onto one of the 4" x 6" coated panels. Due to the thickness of the steel panel to which the coating was applied, the impact resistance was evaluated by examining the location of impact for cracks or voids in the coating film only (ASTM D 2794 recommends a 0.025 gage steel substrate). Following impact, the panel was evaluated for tensile (pull-off) adhesion (described below).

Tensile (Pull-Off) Adhesion

Tensile adhesion testing was performed on the coating material to determine pull-off strength in accordance with ASTM D 4541, "Pull-Off Strength of Coatings Using Portable Adhesion Testers," Annex A.2, "Fixed Alignment Adhesion Tester Type II." The surface of each sample was gently cleaned using a cloth. Triplicate pre-abraded dollies were attached to the coating on each sample using two component, 100% solids epoxy adhesive (Araldite 2011). The adhesive was allowed to cure for 48 hours at 70 ± 2°F and 50 ± 5% RH. The dollies were then detached using a fixed alignment adhesion tester manufactured by Elcometer of Manchester, England, capable of applying a force of up to 1000 psi to the dolly. The force required to disbond each dolly (in psi) was recorded along with the location of break. The location of break is defined as adhesion (a distinct split between layers or between the substrate and the first layer), cohesion (a split within a single layer), or epoxy adhesive (coating adhesion/cohesion strength exceeds glue strength). The results of the adhesion testing can be found in Table 5, below.

Table 5 – Results of Tensile (Pull-Off) Adhesion Testing

Panel ID	Exposure	Dolly	Tensile Adhesion Strength (psi)	Location of Break	Average Tensile Adhesion Strength
1	Non-Exposed	A	170	100% adhesive failure of coating to steel	190 psi
		B	170	100% adhesive failure of coating to steel	
		C	230	100% adhesive failure of coating to steel	
2	Accelerated Weathering	A	100	100% adhesive failure of coating to steel	110 psi
		B	50	100% adhesive failure of coating to steel	
		C	170	100% adhesive failure of coating to steel	
3	Impact	A	330	100% adhesive failure of coating to steel	280 psi
		B	200	100% adhesive failure of coating to steel	
		C	300	100% adhesive failure of coating to steel	
4	Thermal Cycling	A	200	100% adhesive failure of coating to steel	330 psi
		B	370	100% adhesive failure of coating to steel	
		C	420	100% glue failure	

Shrinkage and Thermal Expansion

The coating material was evaluated for resistance to shrinkage and thermal expansion in accordance with ASTM C 531, "Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes." Two 6.0" x 1.0" molds of the liquid coating material were made. Replicate determinations were not performed due to the amount of liquid coating material provided. The sample was evaluated for shrinkage after fourteen (14) days at ambient laboratory conditions (25°C, 50% RH). No shrinkage of the sample was observed. The other mold was evaluated for thermal expansion by placing it in an oven maintained at 100°C for sixteen (16) hours. The sample was then evaluated for thermal expansion. None was observed.

Maximum Withstanding Temperature

The coating material was evaluated for the maximum withstanding temperature by employing ASTM E 1356, "Standard Test Method for Assignment of the Glass Transition Temperature by Differential Scanning Calorimetry." A differential scanning calorimeter (DSC) was used to determine the point of degradation of the free-film sample because no glass transition could be clearly identified. Testing revealed the maximum withstanding temperature to be 275°C.

If you have any questions or comments regarding this report, please contact me at 412-788-1300, extension 205.

Very truly yours,

KTA-TATOR, INC.

Carly M. Pravlik
Chemist

CMP/CLO/WDC:jas
JN250065
Jas05143

Polycoat 250065

Date	Hours	Cup #A(g)	Cup #A(grain)	Cup #B(g)	Cup #B(grain)	Cup #C(g)	Cup #C(grain)
04/08/05	0.0	292.62	4515.13	314.60	4854.28	313.02	4829.90
04/08/05	0.0	292.62	4515.13	314.60	4854.28	313.02	4829.90
04/12/05	95.0	292.87	4518.98	314.80	4857.36	313.27	4833.76
04/13/05	118.0	292.94	4520.06	314.85	4858.14	313.33	4834.68
04/14/05	148.0	293.01	4521.14	314.90	4858.91	313.40	4835.76
04/19/05	263.0	293.26	4525.00	315.09	4861.84	313.63	4839.31
04/21/05	318.0	293.51	4528.86	315.27	4864.62	313.84	4842.55
04/22/05	342.0	293.57	4529.79	315.32	4865.39	313.91	4843.63
04/25/05	411.0	293.76	4532.72	315.47	4867.70	314.09	4846.41
04/29/05	508.5	294.00	4536.42	315.66	4870.63	314.33	4850.11
05/12/05	821	294.88	4550.00	316.34	4881.13	315.16	4862.92

	A	B	C
Thickness(in)	0.1240	0.1240	0.1240
Radius (in)	1.9375	1.9375	1.9375
Radius (m)	0.0492	0.0492	0.0492
Area (sq.m)	0.0076	0.0076	0.0076
Slope (grams/hr)	0.0028	0.0021	0.0026
Area (sq.ft.)	0.0819	0.0819	0.0819
WVT(grams/24hr/sq.m)	8.832	6.624	8.201
Permeance(WVP metric perms)	0.002	0.002	0.002
Permeability (perm cm)	0.00	0.00	0.00
Slope (grains/hr)	0.0432	0.0324	0.0401
WVT(grains/hr/sq.ft.)	0.5275	0.3957	0.4899
Permeance (WVP)	0.00376	0.00282	0.00349
Permeability (perm in.)	0.00047	0.00035	0.00043

METRIC AVERAGES:

WVT (grams/24hr/sq.m)	7.88587
Permeance (metric perms)	0.00221
Permeability (perm cm)	0.00070

ENGLISH AVERAGES:

WVT(grains/hr/sq.ft)	0.47101
Permeance (English perms)	0.00335
Permeability (perm in.)	0.00042