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Test Report

Water Vapour Transmission Rate testing for

Megapoxy 206
Megapoxy 206 Ultra
Megapoxy 254 Ultra White
Megapoxy H
Megapoxy MC
Megapoxy P1

Report by Chirag Dave
Laboratory Manager

January 2015

Equipment Used : Sartorius 7200 g Laboratory Scale

Model : PMA-7200

Seriel Number : 24307986

Last Calibrated : September 2014

Water Vapour Transmission Rate Testing

The Water Vapour Transmission (WVT) rate of Vivacity Engineering P/L products is being evaluated in accordance with ASTM E96, “Standard Test Methods for Water Vapour Transmission of Materials”; Procedure B – Water Method at 23 °C, Procedure BW – Inverted Water Method at 23 °C and Procedure D – Water Method at 32.2 °C.

ASTM E96 Water Vapour Transmission Rate Test Method

Items to be tested

The list of Vivacity Engineering P/L products to be tested for the Water Vapour Transmission Rate is provided as follows:

1. Megapoxy 206 (thickness 1.0 mm)
2. Megapoxy 206 Ultra (thickness 1.0 mm)
3. Megapoxy 254 Ultra White (thickness 3.0 mm)
4. Megapoxy H (thickness 1.0 mm)
5. Megapoxy MC (thickness 1.0 mm)
6. Megapoxy P1 (thickness 3.0 mm)

All the samples are to be prepared as per the guidelines set in ASTM D1338 - 99(2011) Standard Practice for Working Life of Liquid or Paste Adhesives by Consistency and Bond Strength.

Testing Procedure

The 2 parts of each product are to be mixed as per Laboratory Procedure V202 – Mixed Sample Preparation and the mix ratio chart to form the respective sample disks. The mixture must be well-mixed, ensuring minimal air entrapment.

4 sample disks are to be prepared for each product as per Laboratory Procedure V205 – Barcol Hardness and allowed to cure for a minimum of 7 days at 25 °C.

Sample disks for Megapoxy 206, Megapoxy 206 Ultra Grey, Megapoxy H and Megapoxy MC are to be made by pouring the mixed liquid sample slowly on clean flat stainless steel lids to obtain an allowable uniform thickness of 1.0 mm. Special care will be taken to ensure no bubbles surfaced on the sample.

Sample disks for Megapoxy 254 Ultra White and Megapoxy P1 are to be prepared by transferring 200 grams of mixed paste sample on siliconised paper laid taut on flat glass surface and compressing the sample down with a heavy block, ensuring a minimum sample depth of 3.0 mm and free from any mechanical damage such as stretch marks or uneven rough surface.

The mouth openings of 24 glass jars (250 ml) will be sanded on a belt sander of the bench grinder to obtain a rough surface for efficient sealing. The jars will be cleaned with plenty of water and dried overnight at 25 °C. The average area of jar mouth opening is 0.0022 m^2. Each jar will be filled with approximately 100 ml of water. The weights of the test jars and water are to be recorded individually.

The weight of the sample disks are to be recorded before attaching them to the jars using structural rapid set Megapoxy PF Gel. This is to ensure that vapour transfer is only through the surface of the sample being tested.

The test samples are to be identified with a felt tip pen on the glass jars. For instance;

206	Product name
T1	T for Top-side sample numbered 1 (B for Bottom-side)
01-09-14	Date of sample assembly

The test samples are to be allowed to come to condition overnight at 25 °C before being weighed for the first time along with the sealing. The test samples designated for Procedure BW – Inverted Water Method at 23 °C are to be inverted so that the sample disk is at the bottom of the jar in direct contact with water. The samples are to be checked for any water leakage and poor sealing and the samples found to have water seeping out of the sealing would be discarded.

The samples are to be weighed daily for a period of 240 hours giving a total of 10 data points.

The test samples are to be subjected to 32.2 °C for Procedure D – Water Method at 32.2 °C after being tested at 23 °C.

All tests are to be carried out with caution in controlled atmosphere to assure that any weight loss is due to water vapour transfer through the sample.

The water vapour transmission rate can be calculated using the following formula.

$$WVT = \frac{(G/t)}{A}$$

G = weight change, grams
t = time, hr, 240 hours
G/t = slope of the straight line, gram/hr
A = test area (jar mouth area), m^2, 2.2×10^{-3}
WVT = rate of water vapour transmission, gram/hr m^2

The permeance, in g/Pa s m^2, can be calculated using the following formula.

$$Permeance = \frac{WVT}{S[R_1 - R_2]}$$

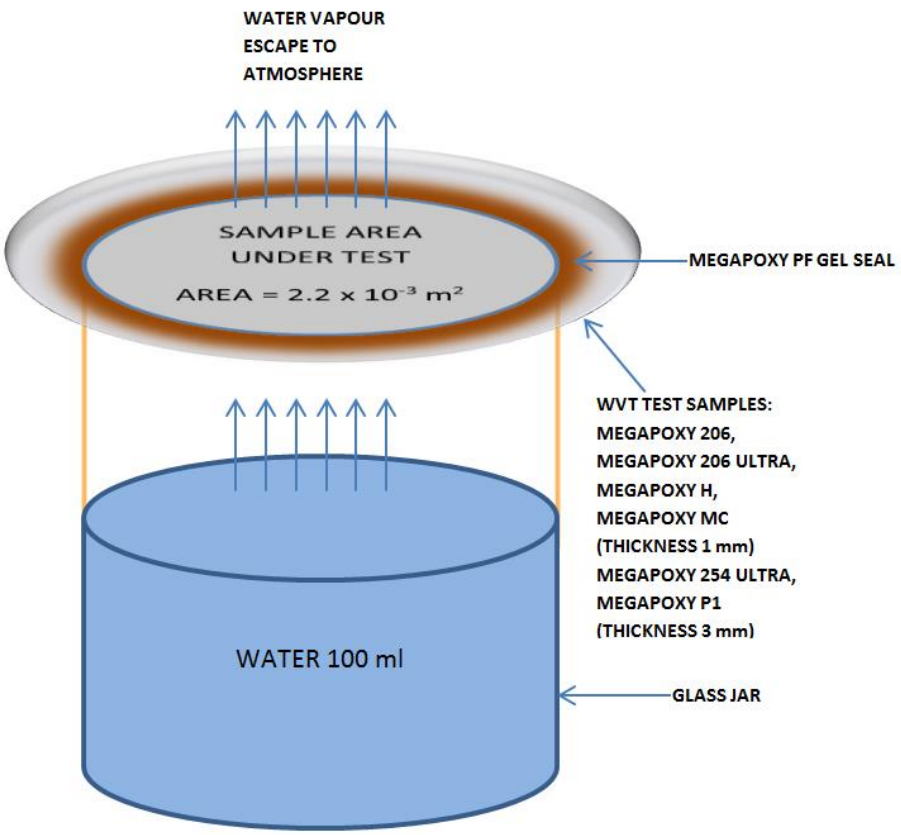
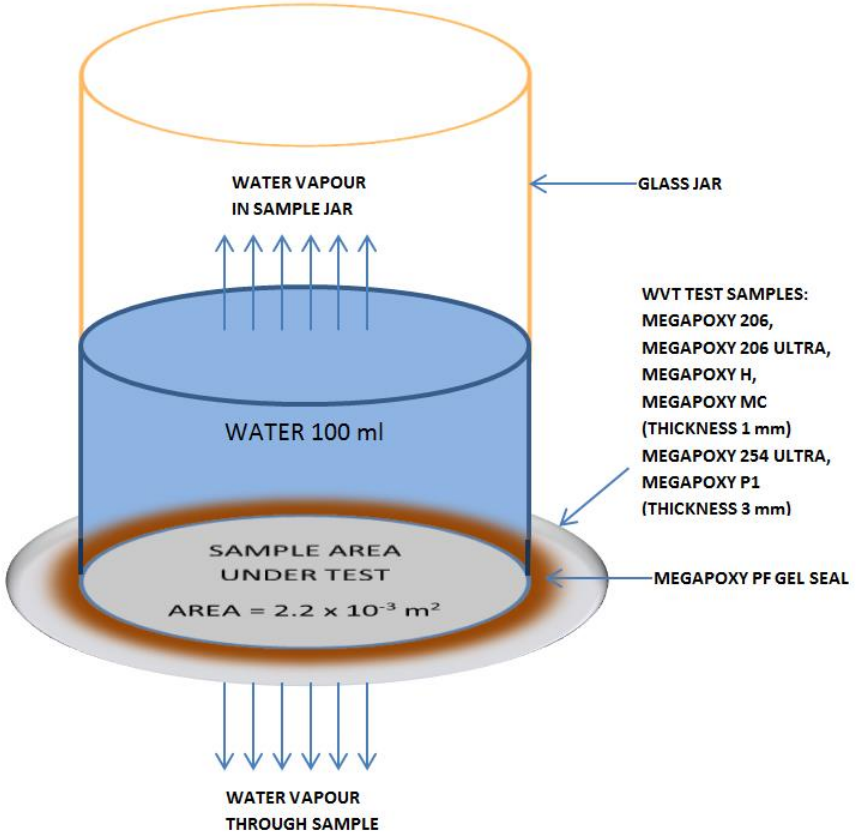
S = saturation vapour pressure at test temperature, Pa
2.8086×10^3 Pa @ 23 °C and 4.8091×10^3 Pa @ 23 °C
R_1 = relative humidity at the source (test jar), 50%
R_2 = relative humidity at the vapour sink, 0%

Referenced Documents

ASTM D907 - 12a Standard Terminology of Adhesives
ASTM C192 / C192M, Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory (Modified)
ASTM C31 / C31M, Standard Practice for Making and Curing Concrete Test Specimens in the Field (Modified)
ASTM D1640-03(2009) Standard Test Methods for Drying, Curing, or Film Formation of Organic Coatings at Room Temperature
ASTM D2583 - 13a Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor (Modified)

ASTM D2240 - 05(2010) Standard Test Method for Rubber Property—Durometer Hardness (Modified)
ASTM D570 - 98(2010)e1 Standard Test Method for Water Absorption of Plastics (Modified)
ASTM D2202 - 00(2010) Standard Test Method for Slump of Sealants (Modified)
ASTM D1875 - 03(2013) Standard Test Method for Density of Adhesives in Fluid Form
ASTM D1084 - 08 Standard Test Methods for Viscosity of Adhesives
ASTM D4016-14 Standard Test Method for Viscosity and Gel Time of Chemical Grouts by Rotational Viscometer (Modified Laboratory Method)
ASTM D2196 - 10 Standard Test Methods for Rheological Properties of Non-Newtonian Materials by Rotational (Brookfield type) Viscometer
ASTM D1338 - 99(2011) Standard Practice for Working Life of Liquid or Paste Adhesives by Consistency and Bond Strength
ASTM D2651 - 01(2008) Standard Guide for Preparation of Metal Surfaces for Adhesive Bonding (Modified)
ASTM C679-03(2009)e1 Standard Test Method for Tack-Free Time of Elastomeric Sealants
ASTM D4541 - 09e1 Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers
ASTM D3163 - 01(2014) Standard Test Method for Determining Strength of Adhesively Bonded Rigid Plastic Lap-Shear Joints in Shear by Tension Loading

Figure 1. Experimental Schematic for Water Vapour Transmission Rate Test

Procedure B – Water Method at 23 °C	Procedure BW – Inverted Water Method at 23 °C
	

The experiment setup shown in Figure 1 is also applicable for Procedure D – Water Method at 32.2 °C.

Test Result

Table 1. Procedure B – Water Method at 23 °C

Product Test Sample	Day 1 Weight (gram)	Day 10 Weight (gram)	Weight loss/gain (gram)	WVT Rate (gram/hr m^2)	Permeance (gram/Pa s m^2)
206 T1 01-09-14	273.80	273.80	0.00	0.00	0.00
206 T2 01-09-14	271.50	271.50	0.00	0.00	0.00
206U T1 01-09-14	271.10	271.10	0.00	0.00	0.00
206U T2 01-09-14	274.85	274.85	0.00	0.00	0.00
254U T1 11-09-14	301.45	301.45	0.00	0.00	0.00
254U T2 11-09-14	311.40	311.40	0.00	0.00	0.00
H T1 01-09-14	270.70	270.70	0.00	0.00	0.00
H T2 01-09-14	270.10	270.10	0.00	0.00	0.00
MC T1 23-09-14	274.50	274.50	0.00	0.00	0.00
MC T2 23-09-14	276.65	276.65	0.00	0.00	0.00
P1 T1 11-09-14	307.70	307.70	0.00	0.00	0.00
P1 T2 11-09-14	308.85	308.85	0.00	0.00	0.00

Table 2. Procedure BW – Inverted Water Method at 23 °C

Product Test Sample	Day 1 Weight (gram)	Day 10 Weight (gram)	Weight loss/gain (gram)	WVT Rate (gram/hr m^2)	Permeance (gram/Pa s m^2)
206 B1 01-09-14	276.20	276.20	0.00	0.00	0.00
206 B2 01-09-14	272.15	272.15	0.00	0.00	0.00
206U B1 01-09-14	271.90	271.90	0.00	0.00	0.00
206U B2 01-09-14	269.75	269.75	0.00	0.00	0.00
254U B1 11-09-14	309.00	309.00	0.00	0.00	0.00
254U B2 11-09-14	313.10	313.10	0.00	0.00	0.00
H B1 01-09-14	273.50	273.50	0.00	0.00	0.00
H B2 01-09-14	268.40	268.40	0.00	0.00	0.00
MC B1 23-09-14	271.80	271.80	0.00	0.00	0.00
MC B2 23-09-14	277.35	277.35	0.00	0.00	0.00
P1 B1 11-09-14	322.60	Discarded – Seal faulty			
P1 B2 11-09-14	311.40	311.40	0.00	0.00	0.00

Table 3. Procedure D – Water Method at 32.2 °C

Product Test Sample	Day 1 Weight (gram)	Day 10 Weight (gram)	Weight loss/gain (gram)	WVT Rate (gram/hr m^2)	Permeance (gram/Pa s m^2)
206 T1 01-09-14	273.80	273.80	0.00	0.00	0.00
206 T2 01-09-14	271.50	271.50	0.00	0.00	0.00
206 B1 01-09-14	276.20	276.20	0.00	0.00	0.00
206 B2 01-09-14	272.15	272.15	0.00	0.00	0.00
206U T1 01-09-14	271.10	271.10	0.00	0.00	0.00
206U T2 01-09-14	274.85	274.85	0.00	0.00	0.00
206U B1 01-09-14	271.90	271.90	0.00	0.00	0.00
206U B2 01-09-14	269.70	269.70	0.00	0.00	0.00
254U T1 11-09-14	301.45	301.45	0.00	0.00	0.00
254U T2 11-09-14	311.40	311.40	0.00	0.00	0.00
254U B1 11-09-14	309.00	309.00	0.00	0.00	0.00
254U B2 11-09-14	313.10	313.10	0.00	0.00	0.00
H T1 01-09-14	270.65	270.65	0.00	0.00	0.00
H T2 01-09-14	270.10	270.10	0.00	0.00	0.00

H B1 01-09-14	273.50	273.50	0.00	0.00	0.00
H B2 01-09-14	268.40	Discarded – Seal faulty	0.00	0.00	0.00
MC T2 23-09-14	276.65	276.65	0.00	0.00	0.00
MC B1 23-09-14	271.80	Discarded – Seal faulty			
MC B2 23-09-14	277.35	277.35	0.00	0.00	0.00
P1 T1 11-09-14	307.70	307.70	0.00	0.00	0.00
P1 T2 11-09-14	308.85	308.85	0.00	0.00	0.00
P1 B2 11-09-14	311.40	311.40	0.00	0.00	0.00

Concluding comments

There was no water vapour transmission through any of the test samples for all the Vivacity Engineering products used in the ASTM E96 Test Method.