



## Test Report

### Selected Measurements on Tuff Stuff Under Concrete Insulation Supplied to R&D Services by Innovative Energy, Inc.

Prepared For:

Mr. Jim Kouns  
Innovative Energy, Inc.  
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Lowell, IN 46356

R & D Services, Inc.  
P.O. Box 2400  
Cookeville, Tennessee 38502-2400

Report: RD07298

Reviewed by:

A handwritten signature in cursive script, appearing to read 'Ronald S. Graves'.

Ronald S. Graves  
Vice President

June 28, 2007

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## **Bleeding and Delamination Test Report**

Test Number: RD071853BD

Date of Test: May 25, 2007

Specimen Number: 1021070426-12

Date of Manufacture: 2007

Report prepared for: Innovative Energy, Inc. / Jim Kouns

Project: Adhesive Performance (Bleeding and Delamination) of Double Bubble with Foil on One Side-(Tuff Stuff).

### Procedure

This report presents the results of physical tests conducted on material manufactured by Innovative Energy and received by R&D Services, Inc. on April 26, 2007 for quality control testing. Testing was completed on May 25, 2007. The test was performed in accordance with the following test method.

ASTM C 1224-03, "Standard Specification for Reflective Insulation for Building Applications" - Section 9.5.1, Bleeding and Delamination.

### Specimen Preparation:

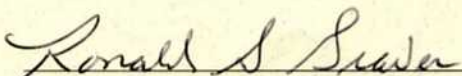
Three (3) 3 by 6 in samples were cut from separate locations on the insulation roll of product.

### Specimen Conditioning:

The specimens were vertically suspended in an oven at conditions of  $180^{\circ}\text{F} \pm 5^{\circ}\text{F}$  and 50 % relative humidity a minimum of 5 hours prior to evaluation.

### Observations:

The Innovative Energy Insulation was observed to have no bleeding or delamination under 5x magnification, thus, meeting the acceptance criteria of Section 9.5.1.4.



Reviewed By:

06-16-07

Date:

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## Pliability Test Report

Test Number: RD071852PL

Date of Test: May 24-25, 2007

Specimen Number: 1021070426-12

Date of Manufacture: 2007

Report prepared for: Innovative Energy, Inc. / Jim Kouns

Project: Adhesive Performance (Pliability) of Double Bubble with Foil on One Side-(Tuff Stuff).

### Procedure

This report presents the results of physical tests conducted on material manufactured by Innovative Energy, Inc. and received by R&D Services, Inc. on April 26, 2007 for quality control testing. Testing was completed on May 25, 2007. The test was performed in accordance with the following test method.

ASTM C1224-03, "Standard Specification for Reflective Insulation for Building Applications" - Section 9.5.2, Pliability

### Specimen Preparation:

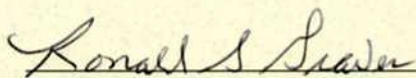
One (1) roll of Double Bubble with Foil on One Side (Tuff Stuff) was supplied to R&D Services, Inc. Two (2) sets of three (3) 3 by 6 in samples were cut from separate locations on the roll of product. One sample in each set contained a factory produced edge.

### Specimen Conditioning:

One set of specimens was conditioned at  $70^{\circ}\text{F} \pm 2^{\circ}\text{F}$  with  $50\% \pm 5\%$  relative humidity and the second set at  $32^{\circ}\text{F} \pm 2^{\circ}\text{F}$  with  $50\% \pm 5\%$  relative humidity a minimum of 24 hours prior to testing.

### Observations:

The specimens were folded in accordance with Section 9.5.2.4 and TAPPI Standard T512om-86. The Innovative Energy Insulation was observed to have no cracking or delamination when folded to an  $180^{\circ}$  bend, thus, meeting the acceptance criteria of Section 9.5.2.4.

  
Reviewed by:

06-16-07  
Date:

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## Thermal Resistance Test Report

Date of Test: May 25, 2007

Date of Manufacture: 2007

HFM File Number: 07-7710

Specimen Number: 1021070426-12

Test Number: RD071851TR

Description of test specimen: Innovative Energy; Double Bubble with Foil on One Side-(Tuff Stuff).

Test Method: ASTM C 518-04, "Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus."

Report prepared for: Innovative Energy, Inc. / Jim Kouns

The results in this report were obtained with a heat-flow meter built and operated in accordance with ASTM C 518-04.

Heat flow meter:	<u>12 by 12</u>	inches x inches
Specimen thickness:	<u>0.314</u>	inches
Specimen density:	<u>2.55</u>	lb/ft <sup>3</sup>
Cold plate temperature:	<u>52.56</u>	deg F
Hot plate temperature:	<u>97.56</u>	deg F
Average specimen temperature:	<u>75.06</u>	deg F
Apparent thermal conductivity:	<u>0.2692</u>	Btu.in/ft <sup>2</sup> .hr.°F
Thermal resistivity ( R-per-inch):	<u>3.715</u>	ft <sup>2</sup> .hr.°F/Btu.in
Thermal resistance of specimen:	<u>1.17</u>	ft <sup>2</sup> .hr.°F/Btu

Notes: Calibration factor used for manual calculation? NA EMF NA

Edge guards or cabinet temperature satisfactory? Yes

Excessive moisture on cold plate? No

Length of time for test (hours)? 3.3

The precision of this test is estimated to be 2.5% (Section 10.3, ASTM C 518-04)

Ronald S. Swader  
 Reviewed By:

06-16-07  
 Date:

The results in this report apply only to the specimen tested. This test conforms to ASTM Test Method C 518-04 except for the report requirements. The report includes summary data but a full complement of data is available upon request.

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## **Compressive Strength Test Report**

Test Number: RD071848CS

Date of Test: May 20, 2007

Specimen: 1021070426-12

Date of Manufacture: 2007

Report prepared for: Innovative Energy, Inc./ Jim Kouns

Description of Material Tested: Double Bubble with foil on one side-Tuff Stuff.

### Test Method:

ASTM D 1621-00 -"Standard Test Method for Compressive Properties of Rigid Cellular Plastics", Procedure A

ASTM D 1621 results in data for the decrease in thickness of a test specimen expressed as a fraction of initial thickness. Test specimens are subjected to a downward compressive force to produce a relationship between applied force and specimen thickness. These data are used to determine the stress (force per unit area) required to reduce the specimen thickness by 10% of its initial value. Material is conditioned in the laboratory at 70 +/-4 F and 50 +/- 5% RH prior to testing. An Instron Model 4400R Universal Testing Machine is used for this test to compress up to 13% of the initial thickness.

### Test:

Number of specimens tested:	10	
Initial thickness of specimens:	0.25	inches
Area of specimens perpendicular to applied force	25	sq. in.
Cross-head speed:	0.10	in./min.

Specimen	Maximum Applied Force (lb <sub>f</sub> )	Compression at Max. Force (in.)	Applied Force @ 10% Compression	Stress @ 10% Compression lb <sub>f</sub> /in <sup>2</sup>
1	2.09	0.250	1.66	0.067
2	1.91	0.250	1.53	0.061
3	1.85	0.250	1.56	0.062
4	2.01	0.250	1.66	0.067
5	2.12	0.250	1.72	0.069
6	1.75	0.250	1.34	0.054
7	1.93	0.250	1.53	0.061
8	1.75	0.250	1.24	0.050
9	1.75	0.250	1.34	0.054
10	1.66	0.250	1.24	0.049
Average			1.48	0.059
Standard Deviation			0.18	0.007
Coefficient of Variation			12.2 %	11.9 %

The average value observed for the stress at 10% compression was 1.48 lb<sub>f</sub>/in<sup>2</sup>. Additional observation: The uncertainty in the result for stress at 10% compression is 11.9% at the 95% confidence level.

Reviewed By David W. Yankeese

Date 6/12/07

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## Slow Rate Penetration Resistance

Test Number: RD071849PTDate of Manufacture: 2007Specimen Number: 1021070426-12Date of Test: May 20, 2007

Description of test specimen: Double layer of polyethylene bubble-pack with aluminum foil on one face (Tuff Stuff). The thickness of the material is ¼ inch.

Report prepared for: Innovative Energy, Inc. / Jim Kouns

Test Method: ASTM F 1306 – “Standard Test Method for Slow Rate Penetration Resistance of Flexible Barrier Films and Laminates”.

ASTM F1306 uses a compression tester and a tapered fixture (probe) to determine the force required to force the 0.125-inch fixture tip through the facer. The force required for the penetration is observed to be the maximum point of increasing force as the fixture probe pushes against the surface.

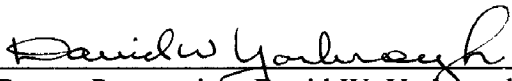
Material Tested: Two layers of polyethylene bubble-pack with aluminum foil on one face. The nominal thickness of the product is 0.25 inch. The product was identified by the name “Tuff Stuff”. The resistance to penetration was determined for the un-faced side. The penetration resistance was measured at the center of a polyethylene bubble since this appears to be the weakest point.

Test Results

Side Tested:	<u>Plastic Facer</u>
Max Force Applied (lb <sub>f</sub> )	30.55
Average of five tests	26.90
Average Displacement at Max Force (inches)	0.038
Stress at Max Force (lb <sub>f</sub> /in. <sup>2</sup> )	2300

The plastic facer was not penetrated.

The precision on the force measurement using this method for results in the range of this test sequence is 27% at the 95% confidence level.

  
Report Preparation: David W. Yarbrough, PhD, PE

6/12/07  
Date

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The results in this report apply only to the specimen tested.



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## Water Vapor Transmission Test Report

Test Number: RD071847WV

Date of Test: May 25-June 8, 2007

Specimen Number: 1021070426-12

Date of Manufacture: 2007

Report prepared for: Innovative Energy, Inc. / Jim Kouns

This report contains the results of a water vapor transmission test done in accordance with ASTM Standard Test Method E 96-05. Results were obtained using the desiccant method described in Section 11 of the Standard. The "perm" being reported was calculated using the method outlined in Section 13 of the Standard. The specimen was tested with a round pan holding the desiccant. The edges of the specimen were sealed to the top ledge of the pan with microcrystalline wax (60%) mixed with refined crystalline paraffin wax (40%).

Description of the Test Specimen: Polyethylene bubblepack with metallized facer on one side.

Manufactured By: Innovative Energy, Inc.

Test Conditions:	Temperature(°F)	73.2
	Relative Humidity (%)	49.8
	Test Duration (hr)	337

	No. 1	No.2	No.3
Test Results:	0.00462	0.00579	0.00488
Weight Gain (g)	0.1503	0.1503	0.1503
Specimen Area (ft <sup>2</sup> )	0.00141	0.00176	0.00149
Water Vapor Transmission (gr/h□ft <sup>2</sup> )	0.825	0.825	0.825
Saturation Pressure (in. Hg)	0.411	0.411	0.411
Pressure Difference (in. Hg)	0.0034	0.0043	0.0036
Permeance (perm, gr/ft <sup>2</sup> □h□(in. Hg))	n/a	n/a	n/a
Permeability (perm□in.)	yes	yes	yes
Figures showing data are attached			

Conclusion:

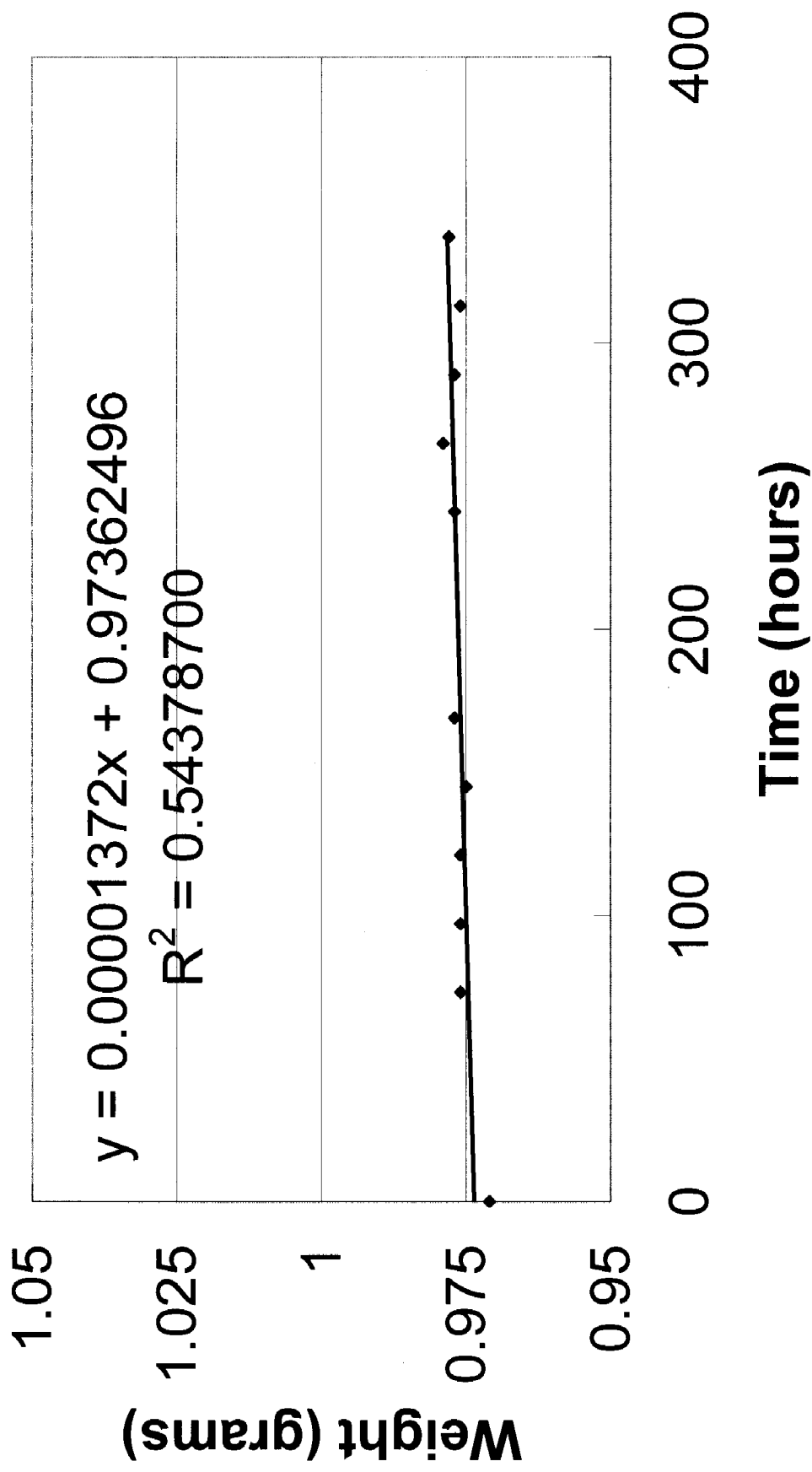
The material exhibited an average permeance of 0.004 perms under the conditions of the test.

David W. Farley  
 Reviewed By:

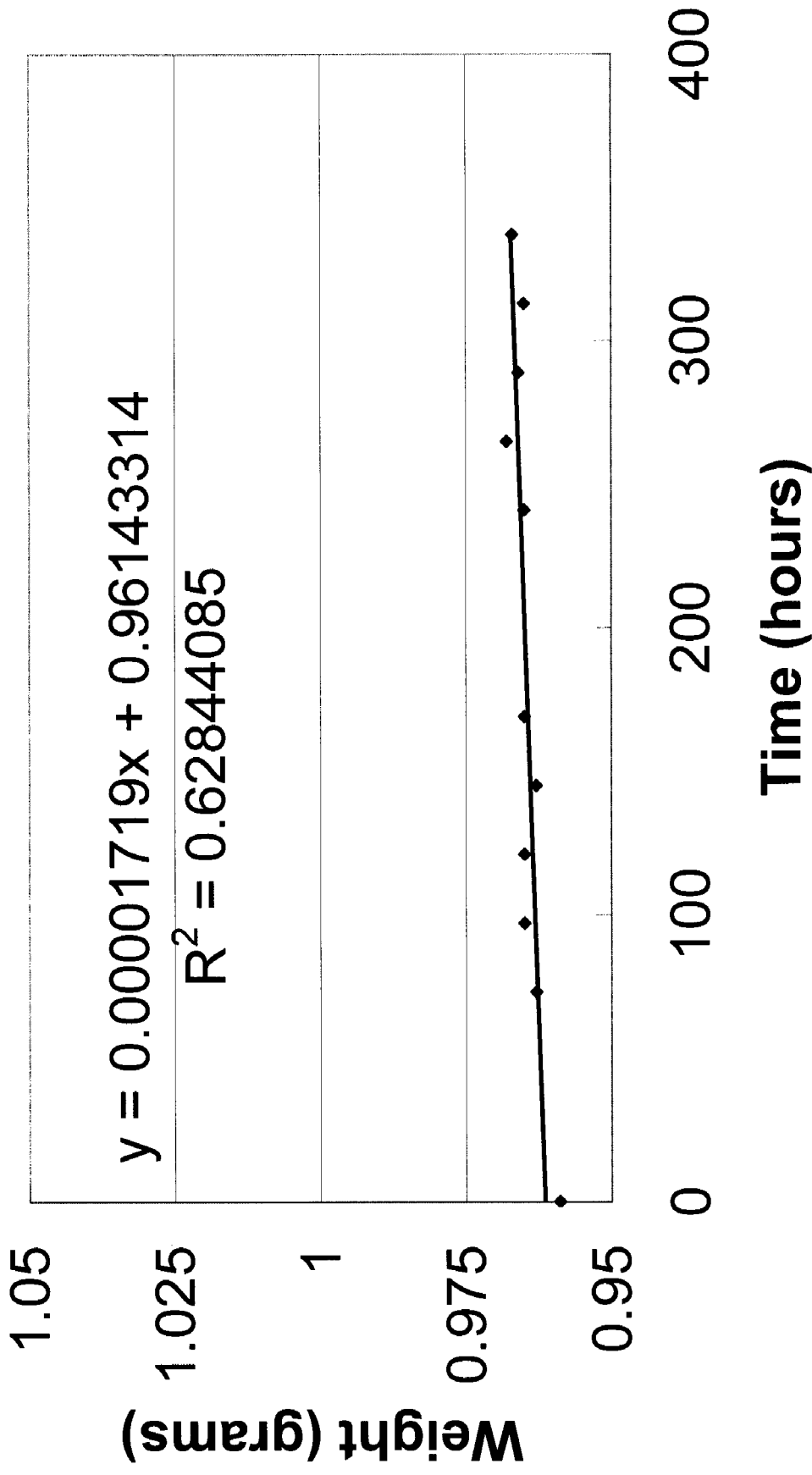
6/12/07  
 Date:

The results in this report apply only to the specimen tested.

# Tuff Stuff Specimen One



# Tuff Stuff Specimen Two



# Tuff Stuff Specimen Three

