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NEWS ALERT

ISO 9001 • ISO 14001
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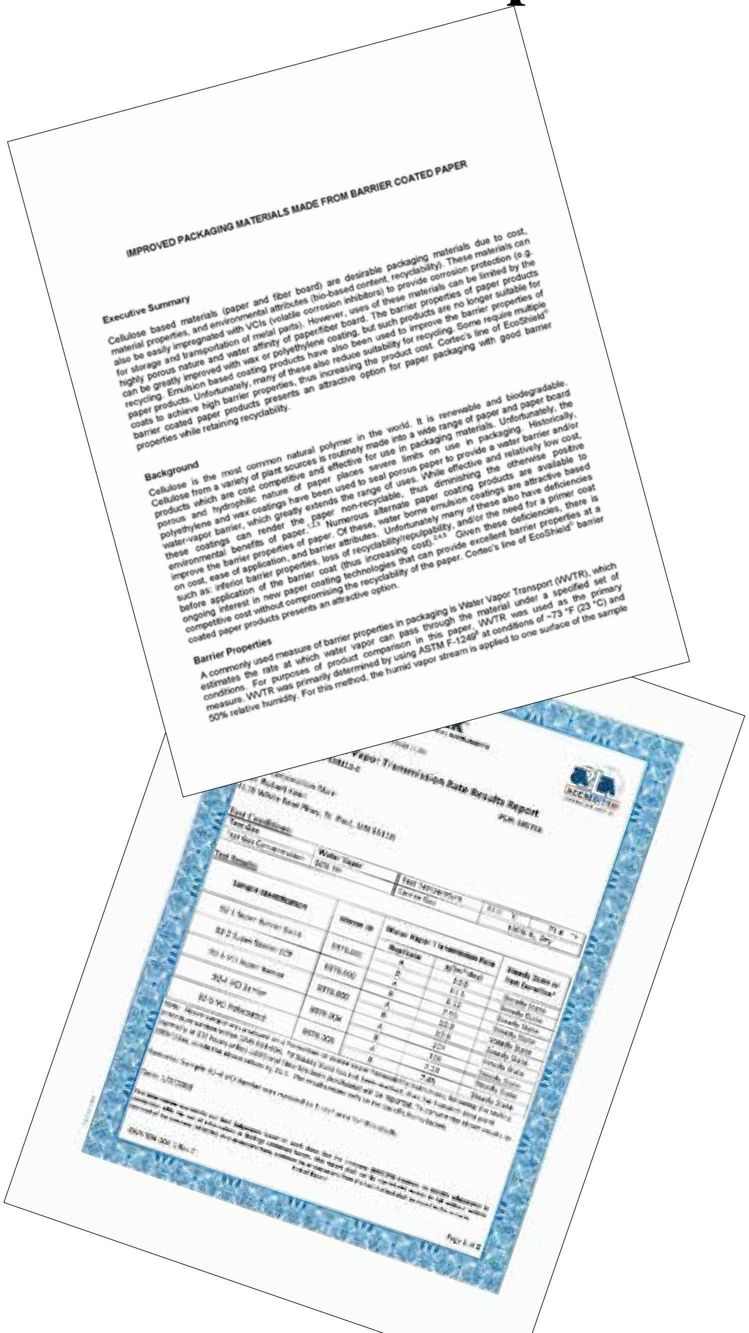
New White Paper Presents Test Results of Recyclable Barrier Coated Paper Compared to Polycoated Paper



A new white paper is available from Cortec® Laboratories on the testing performance of recyclable barrier coated papers developed by Cortec® Corporation. The white paper discusses the question of how to balance the environmental benefits of paper packaging materials with the challenge of maintaining their durability in the presence of moisture. Often, moisture durability is achieved by using barrier coatings that unfortunately reduce the suitability of the paper for recycling.

To achieve good barrier properties while keeping the paper recyclable, Cortec® has developed a line of EcoShield® barrier coated paper products that provide good barrier properties while staying recyclable. Papers with these coatings underwent independent testing for comparison to polycoated and waxed papers. The performance of the EcoShield® Super Barrier papers showed a water vapor transport rate (WVTR) that makes them competitive with polycoated papers, especially when considering the recycling advantage of EcoShield® Super Barrier.

EcoShield® Super Barrier papers provide a balanced solution to the need for both moisture resistance and recyclability. In addition to these barrier and recyclability properties, the EcoShield® VpCI®-144 Super Barrier paper option also has a VCI coating that provides corrosion protection when packaging and shipping metal parts.

Please continue to read the full white paper.

Cortec® Corporation is the global leader in innovative, environmentally responsible VpCI® and MCI® corrosion control technologies for the Packaging, Metalworking, Construction, Electronics, Water Treatment, Oil & Gas, and other industries. Headquartered in St. Paul, Minnesota, Cortec® manufactures over 400 products distributed worldwide. ISO 9001, ISO 14001, and ISO 17025 Certified.

CORTEC CORPORATION
Environmentally Safe VpCI®/MCI® Technologies

IMPROVED PACKAGING MATERIALS MADE FROM BARRIER COATED PAPER

Executive Summary

Cellulose based materials (paper and fiber board) are desirable packaging materials due to cost, material properties, and environmental attributes (bio-based content, recyclability). These materials can also be easily impregnated with VCIs (volatile corrosion inhibitors) to provide corrosion protection (e.g. for storage and transportation of metal parts). However, uses of these materials can be limited by the highly porous nature and water affinity of paper/fiber board. The barrier properties of paper products can be greatly improved with wax or polyethylene coating, but such products are no longer suitable for recycling. Emulsion based coating products have also been used to improve the barrier properties of paper products. Unfortunately, many of these also reduce suitability for recycling. Some require multiple coats to achieve high barrier properties, thus increasing the product cost. Cortec's line of EcoShield® barrier coated paper products presents an attractive option for paper packaging with good barrier properties while retaining recyclability.

Background

Cellulose is the most common natural polymer in the world. It is renewable and biodegradable. Cellulose from a variety of plant sources is routinely made into a wide range of paper and paper board products which are cost competitive and effective for use in packaging materials. Unfortunately, the porous and hydrophilic nature of paper places severe limits on use in packaging. Historically, polyethylene and wax coatings have been used to seal porous paper to provide a water barrier and/or water-vapor barrier, which greatly extends the range of uses. While effective and relatively low cost, these coatings can render the paper non-recyclable, thus diminishing the otherwise positive environmental benefits of paper.[1,2,3] Numerous alternate paper coating products are available to improve the barrier properties of paper. Of these, water borne emulsion coatings are attractive based on cost, ease of application, and barrier attributes. Unfortunately many of these also have deficiencies such as: inferior barrier properties, loss of recyclability/repulpability, and/or the need for a primer coat before application of the barrier coat (thus increasing cost).[2,4,5] Given these deficiencies, there is ongoing interest in new paper coating technologies that can provide excellent barrier properties at a competitive cost without compromising the recyclability of the paper. Cortec's line of EcoShield® barrier coated paper products presents an attractive option.

Barrier Properties

A commonly used measure of barrier properties in packaging is Water Vapor Transport (WVTR), which estimates the rate at which water vapor can pass through the material under a specified set of conditions. For purposes of product comparison in this paper, WVTR was used as the primary measure. WVTR was primarily determined by using ASTM F-1249[6] at conditions of ~73 °F (23 °C) and 50% relative humidity. For this method, the humid vapor stream is applied to one surface of the sample and permeating water vapor is detected via a sensor on the other side of the sample. One sample (waxed paper, described below) was found to be too porous for reliable analysis with the ASTM F-1249 method. That sample was tested using ASTM E-96.[7] For ASTM E-96, disks of the coated paper were attached (and sealed) to a cup filled with freshly regenerated silica gel. The cells were placed in a chamber at ~72 °F (22 °C) and 50% relative humidity. Filled cups were weighed at the start and periodically over the test period, to measure the weight gain due to water vapor permeation (and adsorption onto the silica gel). All testing was conducted at Mocon Inc. Samples were tested in duplicate.

Material Comparisons

Samples of commercial materials from the EcoShield® product line were obtained from Cortec® Coated Products, Eau Claire, WI. These samples consisted of 40# (lbs./3000 square feet) Natural Kraft paper with applied barrier coating and (for VpCI®-144 products) a VCI coating on the side opposite the barrier coating. The Super Barrier products are further passed through a calender step.

The following samples were also tested for comparison:

- A polycoated VCI paper product consisted of 40# Natural Kraft with 6# of polyethylene (PE) extrusion coated on one surface (produced by Plastic Coated Papers Inc., Pensacola, FL), which had a VCI coating applied to the non-polycoated side. The dried finished product is available as Cor-Pak® VpCI® polycoated paper.
- A second polycoated sample was obtained from Walki Oy, Pietarsaari, Finland; nominally 10 GSM (grams/square meter) PE on 75 GSM Bleached Kraft (6# PE on 46# paper).
- Commercial wax paper was obtained at a local grocery store (Waxtex brand, manufactured by Clearwater Paper; Spokane, WA).

Results

The table below shows the test results for the various samples. Results are reported in the commonly used units of $g/h*m^2$ and $g/24h*m^2$. The ID numbers are used for easy reference on the attached Mocon test reports.

Coated Paper Samples	WVTR g/h*m2	WVTR g/24h*m2
92-1 EcoShield® Super barrier	0.44-0.47	10.6-11.3
92-2 EcoShield® Super barrier	0.31-0.34	7.55-8.12
92-3 EcoShield® VpCI®-144 Super barrier	0.43	10.3
94-1 EcoShield® VpCI®-144	0.60-0.68	14.3-16.3
95-1 Walki Polycoated	0.29	6.97-6.98
92-5 Cor-Pak® Polycoated	0.30-0.32	7.23-7.65
97-1 Commercial Waxed Paper‡	1.0-5.4	25.5-130

WVTR tested at 23°C (73°F) and 50% RH, ASTM F-1249 except as noted
‡Due to highly porous and variable sample, could not be tested with ASTM F-1249, so ASTM E-96 was used (run at 22 °C)

Analysis and Conclusions

The test results show that the EcoShield® Super Barrier coated products have WVTR values very competitive with PE coated papers. For all barrier coated products, there will be some variability in coat weight and uniformity. This is reflected in the result differences between samples 92-1 and 92-2. The VpCI®-144 products further contain a VCI coated onto the side opposite the barrier coating, so that this product provides corrosion protection to enclosed metal articles in addition to water vapor barrier. The difference in WVTR results between material 94-1 and 92-3 shows the improvement in WVTR that is achieved with the calender treatment. This can also be seen with the low WVTR values of the other Super Barrier materials (92-1 and 92-2). Of all the samples tested, the waxed paper sample showed the highest and most variable WVTR results. This appears to be primarily due to inconsistent coating uniformity and/or insufficient coat weight; as wax is well known as a good WVTR barrier material.

In selecting packaging materials, one often has to balance a number of important properties. In recent years, packaging sustainability has become much more important in the eyes of manufacturers and customers. For packaging requiring good water vapor barrier properties, Cortec® EcoShield® coated paper products now offer barrier properties competitive with wax coated and PE coated materials, but with the advantage that they are readily repulpable and recyclable.

References

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3. Khwaldia, K.; E. Arab-Tehrany, and S. Desobry “Biopolymer Coatings on Paper Packaging Materials.” Comprehensive Reviews in Food Science and Food Safety, 9 (2010) 82–91.

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6. ASTM F-1249, 2013, “Standard Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor” (West Conshohocken, PA: ASTM).

7. ASTM E-96, 2016, “Standard Test Methods for Water Vapor Transmission of Materials” (West Conshohocken, PA: ASTM).

MOCON Laboratory
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ACCREDITED
CERTIFICATE #4231.01

ASTM F1249 Water Vapor Transmission Rate Results Report

MOCON Job Number 439111-1 **PO#: 101756**

Cortec Corporation-Main
Attn: Robert Kean
4119 White Bear Pkwy, St. Paul, MN 55110

Test Conditions:

Test Gas	Water Vapor	Test Temperature	23.0 °C	73.4 °F
Test Gas Concentration	50% RH	Carrier Gas	100% N_2, Dry	

Test Results:

Sample Identification	Mocon ID	Water Vapor Transmission Rate		Steady State or Test Duration*
		Replicate	g/(m²·day)	
92-1 Super Barrier Stock	8976.001	A	10.6	Steady State
		B	11.3	Steady State
92-2 Super Barrier CCP	8976.002	A	8.12	Steady State
		B	7.55	Steady State
92-3 VCI Super Barrier	8976.003	A	10.3	Steady State
		B	10.3	Steady State
92-4 VCI Barrier	8976.004	A	207	Steady State
		B	106	Steady State
92-5 VCI Polycoated	8976.005	A	7.23	Steady State
		B	7.65	Steady State

Note: Above sample was analyzed on a Permatran-W Water Vapor Permeability Instrument, following the testing procedure written within QMS 504-004. *If Steady State has not been reached, then the transient data point (normally at 120 hours unless additional time has been purchased) will be reported. To convert the above results to 100in²/day, divide the above values by 15.5. The results relate only to the specific items tested.

Remarks: Sample 92-4 VCI Barrier was masked to 5 cm² area for this study.

Date: 1/2/2018

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ASTM F1249 Water Vapor Transmission Rate Results Report

MOCON Job Number 439111-1 **PO#: 101756**

Test Operator: [signature] Date: 1/2/18
Kris Bednarchuk

Authorized by: [signature] Date: 1/2/18
Howard Immel, Standard Lab Supervisor

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ASTM F1249 Water Vapor Transmission Rate Results Report

MOCON Job Number 439630-1 **PO#: 101958**

Cortec Corporation-Main
Attn: Robert Kean
4119 White Bear PKWY, St. Paul, MN 55110

Test Conditions:

Test Gas	Water Vapor	Test Temperature	23.0 °C	73.4 °F
Test Gas Concentration	50% RH	Carrier Gas	100% N_2, Dry	

Test Results:

Sample Identification	Mocon ID	Water Vapor Transmission Rate		Steady State or Test Duration*
		Replicate	g/(m²·day)	
95-1 Polycoated	8996.001	A	6.97	Steady State
		B	6.98	Steady State

Note: Above sample was analyzed on a Permatran-W Water Vapor Permeability Instrument, following the testing procedure written within QMS 504-004. *If Steady State has not been reached, then the transient data point (normally at 120 hours unless additional time has been purchased) will be reported. To convert the above results to 100in²/day, divide the above values by 15.5. The results relate only to the specific items tested.

Remarks: None

Date: 1/17/2018

Test Operator: [signature] Date: 1/17/18
Kris Bednarchuk

Authorized by: [signature] Date: 1/17/18
Howard Immel, Standard Lab Supervisor

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ASTM E 96 Water Vapor Transmission Rate Results Report
MOCON Job Number 110146-1 **PO#:102170**

Cortec Corporation-Main
Attn: Robert Kean
4119 White Bear Pkwy, St. Paul, MN 55110

Test Conditions:

Test Gas	Water Vapor	Test Temperature	22.0°C	71.6°F
Test Gas Humidity	50%RH	Desiccant	0%RH	

Test Results:

Sample Identification	Mocon ID	Water Vapor Transmission Rate		Steady State
		Replicate	grams/(m²·day)	
97-1 Wax Paper	9020.002	1	25.5	Steady State
	9020.002	2	130	Steady State
	9020.002	3	36.2	Steady State

Note: Above sample was analyzed for water vapor transmission rate via gravimetric methodology associated with ASTM standard E-96. The results relate only to the specific items tested.

Remarks: Dry cup gravimetric analysis.

Date: 2/15/2018

Test Operator: [signature] Date: 2/15/18 Authorized by: [signature] Date: 2/15/18
Carrie Skagerberg Joel Fischer

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ASTM F1249 Water Vapor Transmission Rate Results Report

MOCON Job Number: 440146-1 **PO#: 102170**

Cortec Corporation-Main
Attn: Robert Kean
4119 White Bear Pkwy, St. Paul, MN 55110

Test Conditions:

Test Gas	**Water Vapor**	Test Temperature	23.0 °C	73.4 °F
Test Gas Concentration	50% RH	Carrier Gas	100% N_2, Dry	

Test Results:

Sample Identification	Mocon ID	Water Vapor Transmission Rate		Steady State or Test Duration*
		Replicate	g/(m²·day)	
94-1 VCI Barrier Coating	9020.001	A	16.3	Steady State
		B	14.3	Steady State

Note: Above sample was analyzed on a Permatran-W Water Vapor Permeability Instrument, following the testing procedure written within QMS 504-004. *If Steady State has not been reached, then the transient data point (normally at 120 hours unless additional time has been purchased) will be reported. To convert the above results to 100in²/day, divide the above values by 15.5. The results relate only to the specific items tested.

Remarks: None.

Date: 2/15/2018

Test Operator: [signature] Date: 2/15/18
Carrie Skagerberg

Authorized by: [signature] Date: 2/15/18
Joel Fischer, Lab Manager

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