



POLYETHYLENE REPLACEMENT BARRIER COATINGS

Introduction

Polyethylene has dominated as a barrier coating in packaging because of its low cost, versatile properties, and the ease with which it processes.

However, now more and more printers and converters are responding to requests for paper and paperboard coatings that can replace petroleum-based extrusion coated polyethylene. Alternative barrier coating products that are safe for the environment are in favor due to brand marketers, legislative, political and consumer pressure.

Need for replacing Polyethylene (PE)

The aim is to reduce the use of petroleum-based plastics. To enhance moisture resistance and grease resistance, paper-based packaging is frequently coated with polyethylene (PE). However, packages coated with PE may be challenging to recycle at a standard recycling facility. Often PE coatings may contaminate fibers during the repulping process, prohibiting the fiber from being recycled. The vast majority of polyethylene coated substrate is dumped into landfills where the paper portion degrades quickly, while the PE portion is estimated to take decades to breakdown. Polyethylene has dominated as a barrier coating in packaging applications because of its low cost, versatile properties and the ease with which processes.

PE coated paperboard and paper are considered to be "bullet proof" by many, offering an exceptional barrier performance. Therefore, these substrates are broadly accepted and are generally not subjected to barrier testing by printers or converters.

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What are Barrier Coatings?

Water based barrier coatings are water-based dispersions of film forming polymer(s), additives, and possibly pigments. Barrier coatings seal the substrate surface and protect the packaging from external and internal influences. The packaging remains attractive and can fulfill its functionality without restrictions. Depending on the product, barrier coatings offer adequate protection against fat, water, water vapor, dairy products, alcohol, oil or alkali for the packaging. Due to their versatility, they are used for a wide range of applications.

Applications for barrier coatings include food bags and wraps, food trays, paper plates and cups, take out containers, folding cartons and boxes, flexible packaging, and other protective packaging. Food packaging & food service products can rapidly lose their appeal to consumers if grease and oil staining or water degrades their

appearance.

Barrier coatings are highly specialized systems. Mostly, the barrier effect depends on the filling material, the substrate used and the application weight. To be able to make the right recommendation, information on the printing process, substrates, finishing and final packaging is necessary.

Desired Barrier Coating Properties

Depending on the product, barrier coatings are required to show certain valuable characteristics. Compiling the different important properties encompassed by barrier coatings.

- Oil & Grease Resistant
Liquid Water Resistant
Low in Odor Permeability
Visual appearance (glossy, satin, matt)
Heat seal-ability
Non-blocking
High wet block resistance
High scuff resistance
Heat resistance
Re-cyclability
Consistent Coefficient of friction (CDF)
Direct food contact FDA compliant.

Heat Sealable Barrier Coatings

Many paper or paperboard packages, for example, paper cups for food or drink services require the paper or paperboard be heat sealable, making it possible to form cups on a cup machine. Polyethylene extrusion coated paperboard currently still dominates in such applications by providing both required barrier and heat seal properties. However, as discussed above there are increasing demands for replacing PE with a barrier coating which not only provides excellent water and oil resistance, but also can seal the paper material on application of heat.

Most polymers in aqueous coatings are amorphous and do not have a melting point as PE (110 °C). Therefore, binders or polymers in aqueous coatings often gradually soften or become sticky at elevated temperature (49 – 54 °C) and/or pressure in production, storage, shipping, or converting process of aqueous coated paperboard, causing blocking issue of the coated paperboard, which usually does not occur with PE coated paperboard in practical applications.

This blocking issue becomes even more critical for aqueous barrier coated paperboard that requires high barrier properties and needs to be able to heat seal in converting packages such as cups and aluminium pouch packaging. Hence, maintaining the glass transition temperature of the bind for such applications becomes a very critical parameter.

Testing Barrier Coating Properties

COBB TEST

The Cobb test determines the amount of water absorbed into the

INDUSTRY NEWS: The robust growth in Paper Bag market due to rising demand for eco-friendly packaging. The Indian Packaging Industry is projected to register a CAGR of 12.60% during the forecast period 2022-2027.. W&F has launched new packaging solution with ULTRA FL brand Forming fabric for customer quality need. W&F takes necessary fumigation and safety measures in packing of fabric and screens before movement, this ensures safety at consumption end.

surface by sized (non-bibulous) paper, paperboard, and corrugated fiberboard paper or paperboard sample in a set period, usually 60 or 180 seconds (Cobb 60 or Cobb 180). The water absorption is expressed in g/m<sup>2</sup>.

**KIT TEST:**

Kit test is typically performed to evaluate the oil and grease resistance (OGR) properties of the barrier coating. 16 test solutions are prepared by varying the concentrations of Caster oil, Toluene and Heptane. Substrate coated with the barrier coatings are then tested for their resistance of these solutions. Higher the Kit rating, higher is the OGR properties.

Rating	(%)	(%)	(%)	Dynes/cm
1	100	0	0	33.9
2	90	5	5	31.2
3	80	10	10	28.8
4	70	15	15	27.6
5	60	20	20	26.3
6	50	25	25	25.3
7	40	30	30	24.8
8	30	35	35	24.4
9	20	40	40	24.1
10	10	45	45	24.0
11	0	50	50	23.8
12	0	45	55	23.4
13	0	35	65	22.8
14	0	25	75	21.9
15	0	15	85	20.8
16	0	0	100	20.1

**Aroma Barrier**

- Candies
- Chocolate
- Tobacco Products
- Food Products (may require an Antimicrobial Additive)

Test method includes GC-Olfactory techniques – often customer-specific.

**Chemical Resistance**

- Alcohol
- pH

Test methods include TAPPI 559 cm-12 (commonly referred to as the “Kit Test”)

**Recommended Aqueous Barrier Coatings**

- Chemical, Grease, and Moisture Barrier for dryer sheet boxes
- Poly Replacement Coating for donut and bakery boxes
- Oil and Grease Resistance coating for French fry bags, clam shells and pizza boxes.

**Conclusion:**

Barrier coatings for paper and paperboard substrates are ideal for products intended to protect against the leakage of water, water vapor, solvents, oils, fatty acids, and other substances with the environmentally sustainable.

**QUOTABLE QUOTE** “The best measure of **SUCCESS** is how you deal with **FAILURE.**” — **RONNIE RADKE**

**SCRABBLE** email answers by 25<sup>th</sup> Aug’ 23  
Form TWO word : **CONE DIY CIAT**  
First correct answer will win a gift from Wires & Fabriks (S.A.) Ltd. (Maximum two prizes for one person in a year)

**WINNER** JULY 2023  
**Mr. Pradeep Kumar Shibahare, Manager (Technical), M/s ITC PSPD Ltd, Unit: Tribeni, West Bengal**  
**Answer : PULP VISCOSITY**

**?QUIZ** email answers by 25<sup>th</sup> Aug’ 23  
**QUIZ:** Due to \_\_\_\_\_ effect, a slightly higher EMC (Equilibrium Moisture Content) would result if paper approached the EMC for a given relative humidity and temperature, by releasing water.  
(a) Tyndall effect (b) Hysteresis effect (c) Intermolecular effect (d) Van der waal effect

**WINNER** JULY 2023  
**Quiz:** About 65% of the methanol and BOD is concentrated in 6% of the entire condensate stream in the upper portion of the plates just to release  
(a) Four condensate segregation (b) Foul condensate segregation  
© Fine copper segregation (d) Free condensate segregation

**Mr. Prasad Reddy Bora, Sr. Manager (QC), M/s Andhra Papers Ltd, Rajahmundry, Andhra Pradesh.**  
**Answer : (b) Foul condensate segregation**

**Prizes** Best / first correct answer received will win one-year subscription to **IPPTA Journal** (Maximum one prize for one person in a year).

**Teaser**  
Teacher: Count 1 to 10....  
Student: 1,2,3,5,6,7,8,9,10...  
Teacher: Where is 4?? You didn't count it...  
Student: Today in the morning news, I heard that 4 died in a road accident...

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