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HDPE Barrier Lamination Offers Potential for Metalized Film Replacement

Many modern high-barrier packages laminate metalized foil to biaxially-oriented polypropylene (BOPP) or polyethylene terephthalate (PET) film with low density polyethylene (LDPE). The excellent barrier properties of the metalized film layer can contribute to longer shelf life for products like cookies, chips and nuts.

As the use of these types of metalized film packages and pouches increased, the actual barrier end-use requirements began to diminish in importance. As a result, metalized film structures became the default formulation regardless of the actual shelf life needs of the packaging content.

Also, while a long shelf life may be desirable, many food product companies now utilize optimized “just-in-time” supply chain inventories, which may result in product consumption by the consumer many weeks or months prior to the “Best By” date on the package. In such situations, the use of metalized film in the structure may be over-engineered from a barrier point-of-view. As a result, package cost may be higher than necessary to meet typical consumption patterns.

Through new developments in resin design and the use of nucleation technology, high density polyethylene (HDPE) film grades offer potential for improved moisture barrier performance. While the moisture barrier may not be as good as metalized film, blown films using high-barrier HDPE may provide adequate shelf life performance to meet the actual demands of today’s value chain. Therefore, these HDPE films may allow substitution of metalized film in lamination structures at a lower overall cost.

For those end-use products which require oxygen barrier, a co-extrusion blown film line allows the incorporation of an oxygen barrier material such as polyamide or Ethylene-Vinyl Alcohol (EVOH) polymers into a multi-layer film structure. Co-extrusion may also provide the opportunity to use materials that provide other attributes required in packaging films such as good seal strength or low heat seal initiation temperature.

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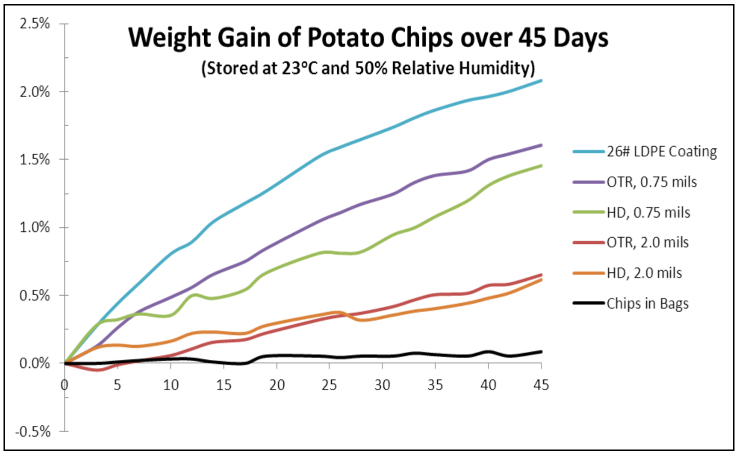
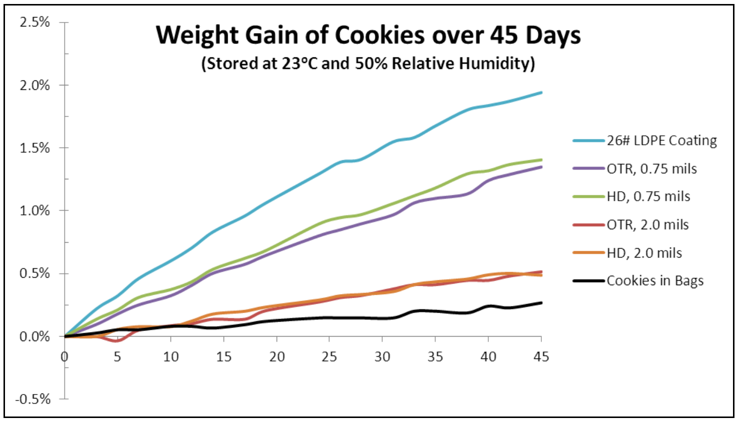
LyondellBasell scientists at the Cincinnati Technology Center conducted a series of studies comparing the current packages and the new HDPE barrier lamination package design to approximate shelf life conditions for potato chips and cookies.

Sets of blown film structures of 0.75 and 2.0 mil thickness were used for these studies. One was a monolayer HDPE film produced with nucleated LyondellBasell *Alathon* M6227SBX01 (identified as HD in the following charts). The other was a co-extrusion of 46% nucleated M6227SBX01, 28% EVOH, and 26% tie-layers (identified as OTR in the charts). These films were laminated to BOPP with LDPE. In addition, a known poor barrier structure was produced by coating the BOPP with a thick layer of LDPE (identified as LDPE Coating).





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After cutting the laminated films into 7 inches by 10 inches samples, the film edges were heat sealed on three sides. This allowed the bags to be filled with the contents of snack-sized packs (1-ounce pack of commercially available potato chips and 100-calorie pack of commercially available cookies). After sealing the fourth edge, the packages were placed in a temperature/humidity-controlled lab, and three specimens from each sample were weighed on Mondays, Wednesdays and Fridays.

The charts on the previous page show the change in weight for the samples. An increase in weight is assumed to correlate to food spoilage, owing to moisture absorption. After 45 days, the weight gain for the samples was:

Structure	Chips	Cookies
Current Bag	0.1%	0.3%
HD, 2.0 mil	0.6%	0.5%
OTR, 2.0 mil	0.7%	0.5%
HD, 0.75 mil	1.5%	1.4%
OTR, 0.75 mil	1.6%	1.4%
LDPE Coating	2.1%	1.9%

Based on these results, it appears the gap in moisture uptake of dry products packed in the current metalized structure and these HDPE laminations is becoming narrower. This may offer the potential for the current over-engineered metallized film packaging to be replaced by simpler, cost-effective HDPE-based film structures with the requisite barrier properties.
Furthermore, material and film structure optimization may lead to further improvements in overall performance.

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