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## Making more of light with 3M's multilayer PEN film

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## PEN barrier properties protect juice

Doehler, Europe's leading supplier of fruit preparations and flavors for the beverage industry, conducted tests on PEN bottles supplied by Rexam, a leading global packaging group. The tests showed PEN protected the product from oxygen and UV light—preserving vitamin C content and minimizing browning—while containing carbon dioxide. Both companies believe that PEN bottles could be an interesting alternative for juice beverage brand owners. [full story](#)

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## Dunlop offers comfort and quiet with PEN tire cord

Dunlop, one of Japan's major tire manufacturers, introduced a new premium tire made with PEN tire cord—the Veuro VE 301. [full story](#)

## Panasonic gives consumers a look inside with PEN inner lid

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## Bottles made with PETN and Amosorb® keep beer fresh in Belize

This year, Bowen & Bowen, Ltd., beer brewer and Belize's Coca-Cola bottler, introduced its Belikin Easter Fest beer in plastic bottles made with PETN and Amosorb oxygen scavenger. [full story](#)



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## Making more of light with 3M's multilayer PEN film

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The secret to the films' effectiveness is PEN's extraordinarily high index of refraction. The multilayer films, with as many as 800 layers, maximize the amount of light that reaches the viewer from within the device.

### Brighter displays, longer-lasting battery charge

The two Vikuiti films made with PEN, enhanced specular reflector film (ESR) and dual brightness enhancement film (DBEF), help direct and recycle source light inside an electronic device that illuminates the screen. In portable devices, such as notebook computers and PDAs, this increase in screen brightness means less power is needed for the display. So manufacturers can reallocate power for a longer battery charge or develop a smaller battery.

Most electronic devices use reflectors around the light source to help direct light out toward the viewer. Even as light bounces off this reflective surface, some is absorbed by it. With multiple bounces, the overall reflectivity of the reflector drops. For example, if a light ray bounces five times off a reflector with an efficiency of 80%, the overall reflectivity drops to 32.7%; for a reflector that is 95% efficient, it drops to 77.3%.



Vikuiti ESR film is 98.5% reflective across the entire visible spectrum of light, giving it an overall reflectivity of 95%. So electronic displays can be brighter, whiter, sunlight-readable and more colorful.

Vikuiti's other film, DBEF, is a reflective polarizer. Most light contains two polarizations. In a standard LCD, only one polarization is emitted through the screen. The other polarization stops at the bottom polarizer. So, in an LCD with DBEF, the film reflects the other polarization back through the polarizer, recycling it so that more of the source light reaches the viewer. Managing the polarization of light in this way can make the display brighter without impacting the viewing angle.

Vikuiti ESR and DBEF films can be used individually or combined to increase performance. Vikuiti films are now

*3M's Vikuiti films take advantage of PEN's index of refraction to sharpen the view on electronic devices.*

increasing the brightness for several different electronic devices, including color cellular phones, notebook PCs, LCD monitors and LCD television applications.

To learn more about 3M's display-enhancement technologies, visit [www.mmm.com](http://www.mmm.com) and enter "Vikuiti" in the search box.

### For more information

3M's Vikuiti Brand Team  
Phone +800-553-9215 (in the U.S.)  
Fax +888-271-3358 (in the U.S.)

## PEN barrier properties protect juice

Doehler, Europe's leading supplier of fruit preparations and flavors for the beverage industry, conducted tests on PEN bottles supplied by Rexam, a leading global packaging group. The tests showed PEN protected the product from oxygen and UV light—preserving vitamin C content and minimizing browning—while containing carbon dioxide. Both companies believe that

PEN bottles could be an interesting alternative for juice beverage brand owners.

The tests compared two PEN bottles, a 38g one-way bottle and a 63g returnable/refillable bottle, against a glass bottle and a 38g PET bottle. The three plastic bottles were 1L, single-layer bottles with a standard closure. The glass bottle was a half-liter bottle

with an aluminum closure. After six months, the loss of vitamin C in both PEN bottles was comparable with glass, as was the extent of browning. After the same time, loss of carbon dioxide was about 5 percent for the glass bottles and 10 percent for the lighter 38g PEN bottle.

For the test, Doehler used its grapefruit-lemon flavored isotonic sport drink. This beverage is very sensitive to oxygen, turning from cloudy white to an obvious brown when oxygen permeates the bottle. Doehler's test helped determine PEN's effectiveness at protecting both flavor and color from oxygen permeating the container.

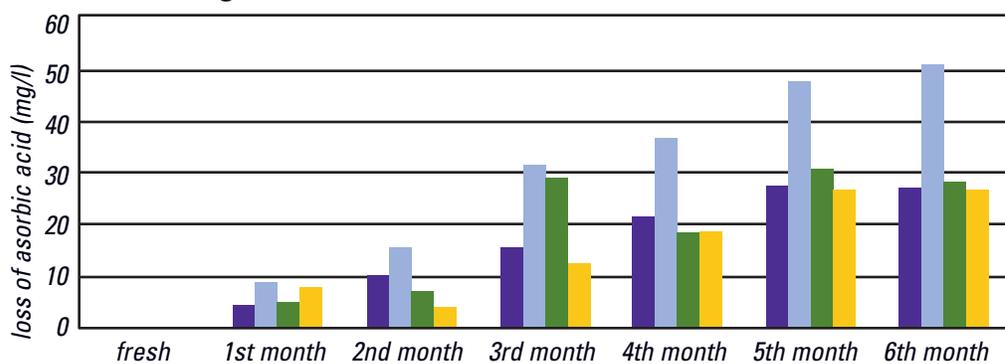
The beverage is also carbonated, at 6g/liter, which allowed the company to determine PEN's effectiveness at containing carbon dioxide. For still drinks, Doehler recommends using liquid nitrogen to fill the headspace of its hot-fill and pasteurized products. This serves to maintain pressure in the bottle as the product cools, while also flushing oxygen from within the bottle for additional protection from loss of flavor and color.

### For more information

Doehler  
Uwe Roebnitz  
Phone +49-6151-306-258  
Uwe.Roebnitz@Doehler.com

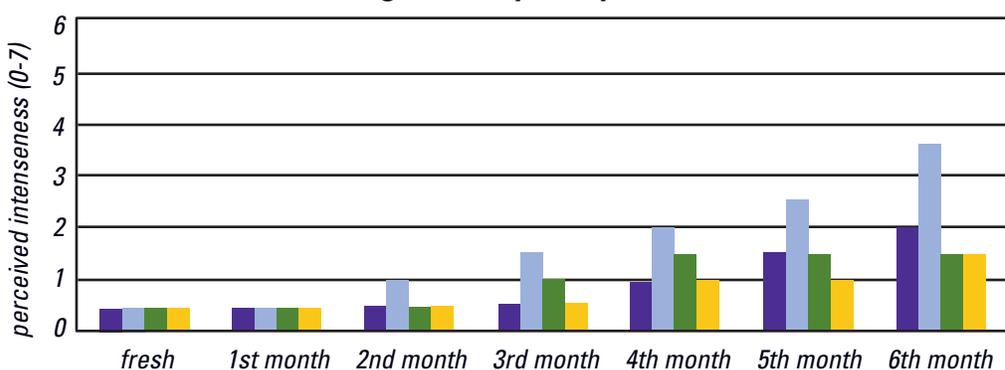
Rexam  
Andreas Jacob  
Andreas.Jacob@rexam.com

Percentage Decrease of Vitamin C



After six months, PEN bottles protect fruit beverage from oxygen as effectively as glass bottles.

Increase of Browning (Sensory Analysis)



After six months, PEN bottles minimize the increase in browning on a par with glass bottles.

- (0) 0.5L Glass
- (A) Rexam 1L PET
- (B) Rexam 1L PEN 38g
- (C) Rexam 1L PEN 63g

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## Dunlop offers comfort and quiet with PEN tire cord

Dunlop, one of Japan's major tire manufacturers, introduced a new premium tire made with PEN tire cord—the Veuro VE 301. PEN's rigidity can reduce the road noise inside the car, and its compression properties create a more comfortable ride.

Marketed with the theme of "Silence," the Veuro reduced road noise in tests conducted by Dunlop. At speeds of 40 km/h, the Veuro reduced noise by 2.4 dB compared with Dunlop's other premium tire, the LeMans LM 702—from 54.5 dB to 52.1 dB. At 60 km/h, the tire reduced noise by 1.6 dB, from 58.7 dB to 57.1 dB. The tire also can have a longer life than comparable tires: 49,845 km vs. 47,851 km.



The Dunlop tire cord is manufactured from PEN resin from Teijin, which is produced with BP's NDC monomer. Under an agreement between Sumitomo Rubber Industries (SRI) and Goodyear, the two companies have created a joint sales organization. SRI sells Goodyear tires in Japan, and Goodyear sells Dunlop tires, including the Veuro, in Europe and the United States.

### For more information

Mitsuru Igarashi  
Manager of Public Relations  
Sumitomo Rubber Industries, Ltd.  
Phone +81-(0)3-5546-0113  
[m-igarashi.az@dunlop.co.jp](mailto:m-igarashi.az@dunlop.co.jp)

## Panasonic gives consumers a look inside with PEN inner lid

Panasonic has introduced a new PEN inner lid on its combination washer/dryer, giving consumers a clear view into the appliance throughout the laundry cycle. The previous inner lid was stainless steel.

Working with Teijin Chemical, Ltd., a resin supplier, Panasonic chose PEN as a replacement for stainless steel over other transparent resins, including PC, PET and PP. To withstand repeated contact with laundry detergent and harsh additives, such as chlorinated products, the lid needed to have excellent chemical resistance. And, to hold its shape during the continuous high temperatures of the drying cycle, it needed to be heat resistant. PEN



*The transparency, chemical resistance and thermal properties of PEN make it an ideal lid for Panasonic's National washer/dryer.*

offered both advantages, along with the crystal clarity that consumers expect from a transparent lid.

Panasonic markets the appliance in Japan under the brand name National, and expects to sell 10,000 to 15,000 units per month.

### For more information

Yutaka Taniguchi  
Matsushita Electric Industrial Co., Ltd.  
Phone +81-6-6331-6758  
[taniguchi.yutaka@national.jp](mailto:taniguchi.yutaka@national.jp)

## Bottles made with PETN and Amosorb® keep beer fresh in Belize

This year, Bowen & Bowen, Ltd., beer brewer and Belize's Coca-Cola bottler, introduced its Belikin Easter Fest beer in plastic bottles made with PETN and Amosorb oxygen scavenger. Used together for the first time, the gas-barrier properties of PETN and the oxygen-scavenging properties of Amosorb preserved the fresh flavor of the ultra-filtration beer long after bottling.

The bottles were such a success among beer drinkers in this Central American country that Bowen & Bowen will use them again later this year for its other two seasonal brews.

"Consumers readily accepted the bottles as convenient, which they are for us, too," says Kevin Bowen, the company's operations manager. "This September, when we bring out our Belikin Independence beer, September Fest, and again at the holidays for our December Fest, we'll simply use different labels on the bottles for a distinct look."

### Ready to go

Kimex of Mexico fabricated the preforms for the screw-cap bottles, which Bowen & Bowen then blow molded into bottles for immediate filling. To ensure success with the full production run of its Easter Fest beer—9,000 cases with 24 bottles to a case—the company ran an initial test a month in advance.

"The lines in our beer plant are for glass bottles, so we ran these on the PET lines in our Coca-Cola plant," says Rolando Santos, plant engineer. "The test let us know what to expect, so the



*PETN bottles with Amosorb oxygen scavenging copolyester offer convenience to bottler Bowen & Bowen and its consumers.*

actual production went without a hitch." Kimex formulated the resin for the 330 ml bottles using PETN copolymer (polyethylene terephthalate with naphthalate from BP's NDC monomer) and 2% Amosorb oxygen scavenging copolyester.

"With PETN's excellent gas barrier and UV protection properties, and Amosorb copolyester's oxygen scavenging activity, the beer kept its superior lager taste for over two months," says Dr. Julio Beltran, Kimex PET division director. Although Amosorb's oxygen scavenging activity begins with exposure to oxygen, preforms can be stored for up to four months with only a modest loss of scavenging capacity. To keep the year's supply of preforms fresh, Kimex packaged them in plastic bags slightly pressurized with nitrogen.

### A pleasant surprise

For beer drinkers in Belize, Belikin's Easter Fest beer this year provided

several pleasant surprises. Typically a pasteurized beer, this year Bowen & Bowen used ultra filtration. The beer offered a fresh-flavored, draft-like alternative to other Belizean beers. "We don't have draft beer in Belize, so our Belikin Easter Fest beer was a new taste for many beer drinkers here," says Santos.

The cap also added a new twist. "We were surprised to find that people continued to use the cap as they drank the beer—opening and then closing the bottle so they didn't have to worry about spilling as they relaxed and enjoyed their drink," Santos says.

The contrast between the room-temperature bottle and the cold beer inside was a new sensation, too—another surprise that consumers seemed to appreciate.

"We're pleased that we were able to offer our consumers a different package and that it has the versatility to allow us to use it again later in the year with other products," says Bowen. "It even gives us the transportability and shelf life we need to begin exporting to other countries."

### For more information

Greg Hussmann  
BP Global Market Manager  
Naphthalates  
Phone +630-420-4336

Julio Beltran  
Kimex PET Division Director  
Phone +52-55-5366-9083

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## contact the naphthalates business group

Please e-mail [naphthalates@bp.com](mailto:naphthalates@bp.com) with any naphthalates-related questions, or contact the office nearest you.

### United States

Sales Administration and  
Customer Service  
150 West Warrenville Road  
Naperville, IL 60563-8460  
Phone +877-701-2726 (in the U.S.)  
Fax +630-961-7680

### Europe

BP Lavera SNC  
BP n° 6  
13117 Lavera, France  
Phone and Fax +33-134-62-06-79

### China

22nd Floor, Devon House  
Taikoo Place  
979 King's Road  
Quarry Bay  
Hong Kong, China  
Phone +852-2586-8899  
Fax +852-2827-1609

### Japan

Petro House 3rd Floor  
4-5-21 Kojimachi  
Chiyoda-ku, Tokyo, Japan 102-0083  
Phone +81-(0)-3-3238-7319  
Fax +81-(0)-3-3238-7343

### Mexico

Av. Revolucion 775  
Col. Nonoalco Mixcoac  
03700 Mexico, D.F.  
Phone +52-55-50632132  
Fax +52-55-56159386

## BP launches new Web site

Late this year, BP will update [www.bp.com](http://www.bp.com) with a new look and feel to better emphasize BP's brand values. The rollout, targeted for early November, will initially focus on BP's petrochemical businesses. Navigating between various BP petrochemical product lines will be significantly improved.

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<b>EVOH</b>	ethylene vinyl alcohol
<b>HDPE</b>	high-density polyethylene
<b>NDC</b>	dimethyl-2,6-naphthalene dicarboxylate
<b>PBN</b>	poly butylene naphthalate
<b>PC</b>	polycarbonate
<b>PEN</b>	polyethylene naphthalate
<b>PET</b>	polyethylene terephthalate
<b>PETN</b>	terephthalate-naphthalate polyester copolymers
<b>RefPEN</b>	returnable/refillable PEN

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