EVOH barrier resins and monolayer film

www.eval-evoh.com
Kuraray Co., Ltd. is the world leader in the production and development of EVOH (ethylene vinyl alcohol copolymer) barrier plastic raw materials. It is available worldwide under the name EVAL™, either in pellet form for coextrusion and coinjection, or as monolayer film for lamination.

1mm of EVAL™ has the same gas barrier as a 10 meter thick wall of LDPE. With such performance, very thin layers of EVAL™ add valuable barrier function to efficient multilayer structures. This barrier function works in both directions, keeping harmful oxygen and contamination away from sensitive products, while locking aroma and value inside.

Multilayer structures provide functional protection with a minimum amount of material. Polyolefins provide cost-effective structure and humidity barrier. PA can provide toughness and assist forming. Tie layers provide structural integrity. EVAL™ provides the necessary gas and migration barrier function to the entire structure.

**OXYGEN TRANSMISSION RATE OF VARIOUS POLYMERS VERSUS RELATIVE HUMIDITY AT 20°C**

<table>
<thead>
<tr>
<th>Polymer</th>
<th>OTR (cm³·20µm/m²·day·atm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LDPE</td>
<td>0.1</td>
</tr>
<tr>
<td>BOPP</td>
<td>1.0</td>
</tr>
<tr>
<td>PVC-U</td>
<td>10</td>
</tr>
<tr>
<td>OPET</td>
<td>100</td>
</tr>
<tr>
<td>OPA6</td>
<td>1,000</td>
</tr>
<tr>
<td>PAN</td>
<td>10,000</td>
</tr>
<tr>
<td>PVDC</td>
<td>ISO14663-2 Annex C standard (65% RH)</td>
</tr>
<tr>
<td>EVAL™ E type (44 mol% ethylene)</td>
<td>100</td>
</tr>
<tr>
<td>EVAL™ F type (32 mol% ethylene)</td>
<td>1,000</td>
</tr>
</tbody>
</table>

**TYPICAL MULTILAYER STRUCTURE WITH EVAL™**

- **Oxygen**
- **Odours**
- **Freshness**
- **Aroma**
- **CO₂**
- **Outer layer**
- **Regrind**
- **Tie**
- **EVAL™ EVOH**
- **Tie**
- **Inner layer**

**AMOUNT OF OXYGEN PERMEATION THROUGH EQUAL THICKNESS OF DIFFERENT PLASTICS**

- EVAL™ F type (32 mol% ethylene)
- EVAL™ E type (44 mol% ethylene)
- BOPP
- OPET
- OPET
- PVC-U
- MXD-6
- EVAL™ E type (44 mol% ethylene)
Making structures more efficient, attractive and safe

The key is to let each component of the structure do what it does best, in an appropriate layer thickness. Different materials combined effectively may actually decrease the total amount of packaging materials required.

EVAL™ provides the functional gas, aroma and grease barrier in food, medical, pharmaceutical and cosmetic packaging, and as a gas and solvent barrier in industrial, construction, agricultural and automotive fuel system applications. All-plastic structures with EVAL™ offer a safe, lightweight, transparent and unbreakable alternative to glass and metal. Thin layers of EVAL™ add reliable barrier to renewable materials like paperboard and PLA. At end of life, structures containing EVAL™ can be recycled, or provide safe energy recovery without toxic emissions or metal residue.

- **METAL CAN**
- **PLASTIC CUP/LID**
- **LIGHTWEIGHT**
- **TRANSPARENT**
- **MICROWAVEABLE**
- **GLASS BOTTLE**
- **EFFICIENT BAG-IN-BOX**
- **UNBREAKABLE**
- **TRANSPORT MORE GOODS**
- **LESS PACKAGING**
- **GLASS JAR**
- **ALL-PLASTIC BARRIER BOTTLE**
- **LIGHTWEIGHT**
- **SQUEEZABLE**
- **USE WITH METAL DETECTORS**
- **STEEL FUEL TANK**
- **PLASTIC FUEL SYSTEM**
- **LIGHTWEIGHT**
- **FREEDOM OF DESIGN**
- **SAFETY IN USE**
Reliable and safe protective function in packaging

High gas barrier properties
*Extended freshness, less waste*
Without an effective gas barrier, oxygen may penetrate packaging and spoil the contents. EVAL™ keeps oxygen out and safeguards quality, extending shelf life and avoiding waste. This cost-saving function is commonly added to food, medical, pharmaceutical, cosmetic, agricultural and industrial packaging applications.

Migration barrier
*Improving food safety*
EVAL™ provides excellent functional barrier against organic solvents, protecting food against the migration of contamination like MOSH/MOAH mineral oils that can compromise food safety. EVAL™ also resists permeation of hydrocarbons and grease, maintaining packaging appearance. In addition to protecting food, this property also protects the environment, locking chemical substances inside safe and convenient plastic packaging.

Aroma barrier, no flavour scalping
*Assuring quality in new forms of distribution*
While keeping oxygen and other gases out, EVAL™ also effectively blocks odours, protecting product integrity. EVAL™ locks volatile fragrance and ingredients inside packaging without absorbing them, and preserves aroma until it can be enjoyed by the consumer.

Transparency
*A clear and reliable alternative to aluminium foil*
All-plastic EVAL™ barrier layers have excellent flex crack and pinhole resistance, even when flexed, folded and shaken during processing and distribution. EVAL™ offers a reliable barrier alternative to Al foil, with the addition of excellent transparency and safe and low-impact energy recovery at end of life.

Process efficiency
*Reduce costs and waste in production and distribution*
Plastic barrier structures with EVAL™ can be designed for aseptic filling, reducing energy use during processing. Lightweight structures with EVAL™ allow transporting more goods instead of unnecessarily heavy packaging. Inexpensive but functional packaging design helps bring quality products to new markets.

Food contact compliance
EVAL™ has passed the specification/standard test of Official Notice No.370 (1959) from Japan’s Ministry of Health and Welfare. EVAL™ is in compliance with the EC Directive on plastic materials intended to come into contact with food. EVAL™ has been approved for use in direct food contact, indirect or multilayer food contact and for retort applications as outlined under the Food and Drug Administration regulations in the USA.
Properties that create value for industry

Hydrophilic, anti-static and glossy appearance
More than just a gas barrier layer
EVAL™ is a hydrophilic polar material with anti-static properties and a glossy appearance when used as an outside layer. In addition to packaging, its unusual mix of properties leads to use as a technical plastic for industrial, electronic and medical components.

Avoiding energy waste and reducing emissions

Extended service life
Special pipe grades maintain cost-saving performance for decades
EVAL™ adds barrier function to structures that were previously not possible with plastics. Barrier plastic pipes for under-floor heating are easy to install and help avoid corrosion, extending service life.

Energy efficiency
Extending the performance of insulation
EVAL™ can replace Al foil in vacuum insulation panels, maintaining the vacuum and efficiency and generating savings. A thin layer of EVAL™ can maintain the insulation properties of Polyurethane foam, used in preinsulated heating and cooling pipes.

Fuel vapour barrier
Safety and environmental protection
Lightweight barrier plastic tanks and lines improve the performance and safety of automotive fuel systems. EVOH is the only conventional plastic that meets strict international emission standards.

Solvent resistance
Safe protection against permeation of solvents and agricultural chemicals
EVAL™ shows excellent physical resistance to solvents, and barrier against their permeation into the environment. Because of its resistance to absorption and swelling, EVAL™ is typically used as the inner contact layer in UN-approved chemical bottles. A safe way to transport chemical concentrates.

Less waste, improved safety for Agriculture
EVAL™ provides the barrier function in TIF™ (Totally Impermeable Film) mulch films. Agricultural chemicals stay where they are needed, reducing emissions and improving safety for workers and nearby residents. Barrier silage films, land silos and hermetic storage bags protect feed and produce until they can be used or shipped to market. UN regulation compliant plastic chemical bottles block emissions from chemical concentrates.
Types of EVAL™

**EVAL™ M type**
has the lowest ethylene content available, and provides the highest barrier for automotive and flexible applications.

**EVAL™ L type**
has a very low ethylene content and is suitable as an ultra-high barrier in flexible, bottle and sheet applications.

**EVAL™ F type**
offers superior barrier performance with long-term process stability, and is widely used as the standard grade for flexible, automotive, bottle and tube applications. Specific versions exist for coating and pipe applications.

**EVAL™ C type**
can be used for high-speed coextrusion coating and cast flexible applications.

**EVAL™ H type**
combines high-barrier properties and long-term run stability and thermoformability. The higher ethylene content allows easier processing and longer running times on older coextrusion equipment, especially for blown flexible structures.

**EVAL™ E type**
has a higher ethylene content that allows for greater flexibility and even easier processing.

**EVAL™ G type**
has the highest ethylene content, making it the best candidate among standard EVAL™ types for stretch and shrink film applications.

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About EVAL™, a Kuraray technology

The EVAL™ copolymer combines the humidity resistance and easy processing of ethylene with the exceptional gas barrier and resistance to organic solvents of polyvinyl-alcohol. By adjusting the balance of the copolymer, Kuraray has created the world’s widest range of EVOH grades. Our global development teams help determine the grade best suited for an application’s required converting and secondary processing.
EVAL™ resin grades

1. Standard grades

<table>
<thead>
<tr>
<th>Grade</th>
<th>Et.Cont. (mol%)</th>
<th>Density*1 (g/cm³)</th>
<th>MFR*2 (g/10min)</th>
<th>Tm (°C)</th>
<th>Tg*3 (°C)</th>
<th>OTR*4 (cm³.20μm/m².day.atm)</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>L171B</td>
<td>27</td>
<td>1.21</td>
<td>4.0*4</td>
<td>190</td>
<td>63</td>
<td>0.1</td>
<td>ultra high-barrier</td>
</tr>
<tr>
<td>F101B</td>
<td>32</td>
<td>1.19</td>
<td>1.6</td>
<td>183</td>
<td>60</td>
<td>0.3</td>
<td>fuel tank, bottle</td>
</tr>
<tr>
<td>F171B</td>
<td>32</td>
<td>1.19</td>
<td>1.6</td>
<td>183</td>
<td>60</td>
<td>0.3</td>
<td>bottle, sheet, film, tube</td>
</tr>
<tr>
<td>H171B</td>
<td>38</td>
<td>1.17</td>
<td>1.7</td>
<td>172</td>
<td>56</td>
<td>0.7</td>
<td>bottle, sheet, film, tube</td>
</tr>
<tr>
<td>E105B</td>
<td>44</td>
<td>1.14</td>
<td>5.5</td>
<td>165</td>
<td>53</td>
<td>1.9</td>
<td>sheet, film, tube</td>
</tr>
<tr>
<td>G156B</td>
<td>48</td>
<td>1.12</td>
<td>6.4</td>
<td>157</td>
<td>50</td>
<td>3.7</td>
<td>oriented shrink film</td>
</tr>
</tbody>
</table>

*1 20°C  *2 190°C, 2,160g  *3 Dry  *4 20°Cx65%RH, ISO 14663-2 annex C  *5 210°C, 2,160g

2. Grades for specific processing conditions

<table>
<thead>
<tr>
<th>Grade</th>
<th>Et.Cont. (mol%)</th>
<th>Density*1 (g/cm³)</th>
<th>MFR*2 (g/10min)</th>
<th>Tm (°C)</th>
<th>Tg*3 (°C)</th>
<th>OTR*4 (cm³.20μm/m².day.atm)</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>F101A</td>
<td>32</td>
<td>1.19</td>
<td>1.6</td>
<td>183</td>
<td>60</td>
<td>0.3</td>
<td>F101 without external lubricant</td>
</tr>
<tr>
<td>F104B</td>
<td>32</td>
<td>1.19</td>
<td>4.4</td>
<td>183</td>
<td>60</td>
<td>0.3</td>
<td>high MFR F-type</td>
</tr>
<tr>
<td>FP101B</td>
<td>32</td>
<td>1.19</td>
<td>1.6</td>
<td>183</td>
<td>60</td>
<td>0.3</td>
<td>extended pipe service life</td>
</tr>
<tr>
<td>FP104B</td>
<td>32</td>
<td>1.18</td>
<td>4.4</td>
<td>183</td>
<td>60</td>
<td>0.3</td>
<td>extended pipe service life</td>
</tr>
<tr>
<td>T101B</td>
<td>32</td>
<td>1.17</td>
<td>2.0</td>
<td>183</td>
<td>55</td>
<td>0.4</td>
<td>thermoformed film, sheet</td>
</tr>
<tr>
<td>J102B</td>
<td>32</td>
<td>1.17</td>
<td>2.0</td>
<td>183</td>
<td>54</td>
<td>0.6</td>
<td>deep thermoforming, sheet</td>
</tr>
<tr>
<td>C109B</td>
<td>35</td>
<td>1.18</td>
<td>8.5</td>
<td>177</td>
<td>53</td>
<td>0.5</td>
<td>extrusion coating</td>
</tr>
<tr>
<td>E171B</td>
<td>44</td>
<td>1.14</td>
<td>1.7</td>
<td>165</td>
<td>53</td>
<td>1.9</td>
<td>low MFR E-type</td>
</tr>
</tbody>
</table>

*1 20°C  *2 190°C, 2,160g  *3 Dry  *4 20°Cx65%RH, ISO 14663-2 annex C  *5 210°C, 2,160g

3. Special grades

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Comparison to standard grades</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermoforming grade</td>
<td>Improved EVAL™ layer distribution during deep thermoforming</td>
<td>SP series, LT series, J171B</td>
</tr>
<tr>
<td>Soft grade</td>
<td>Improved flex-crack resistance with similar barrier</td>
<td>FS201B</td>
</tr>
<tr>
<td>High impact strength grade</td>
<td>Improved impact strength</td>
<td>LA170B</td>
</tr>
<tr>
<td>Fuel tank grade</td>
<td>Ultra high barrier properties for automotive</td>
<td>M100B</td>
</tr>
<tr>
<td>Pipe grade</td>
<td>Provides extended service life at high temperature</td>
<td>FP101B, EP105B</td>
</tr>
<tr>
<td>Retort grade</td>
<td>Retort flexible grade. Improved retort performance for thin transparent structures.</td>
<td>FR101B, LR171B</td>
</tr>
</tbody>
</table>

Please contact us for more information concerning Special grades.

4. SP Grades. Improved orientation and layer distribution during secondary processing.

<table>
<thead>
<tr>
<th>Grade</th>
<th>Et.Cont. (mol%)</th>
<th>Density*1 (g/cm³)</th>
<th>MFR*2 (g/10min)</th>
<th>Tm (°C)</th>
<th>Tg*3 (°C)</th>
<th>OTR*4 (cm³.20μm/m².day.atm)</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>SP521B</td>
<td>27</td>
<td>1.19</td>
<td>4.1*4</td>
<td>190</td>
<td>63</td>
<td>0.2</td>
<td>improved layer distribution in forming</td>
</tr>
<tr>
<td>SP482B</td>
<td>32</td>
<td>1.16</td>
<td>2.0</td>
<td>183</td>
<td>60</td>
<td>0.6</td>
<td>improved film orientation</td>
</tr>
<tr>
<td>SP292B</td>
<td>44</td>
<td>1.13</td>
<td>1.9</td>
<td>165</td>
<td>48</td>
<td>3.0</td>
<td>improved film orientation</td>
</tr>
</tbody>
</table>

*1 20°C  *2 190°C, 2,160g  *3 Dry  *4 20°Cx65%RH, ISO 14663-2 annex C  *5 210°C, 2,160g

5. Processing agents for EVAL™ resin

We also offer the following processing agents, useful for specific EVAL™ resin applications and processing methods

- Recycling agent
- Purging agent

Please contact us for more information.
EVAL™ monolayer film grades

<table>
<thead>
<tr>
<th>Grade</th>
<th>Type</th>
<th>Thickness (µm)</th>
<th>Ethylene Content (mol%)</th>
<th>Density (g/cm³)</th>
<th>OTR (cm³/m².day.atm) 20°C 65% RH ISO 14663-2</th>
<th>Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>EF-XL</td>
<td>Biaxially oriented</td>
<td>12</td>
<td>32</td>
<td>1.20</td>
<td>0.4</td>
<td>high barrier</td>
</tr>
<tr>
<td>EF-F</td>
<td>Non-oriented</td>
<td>12</td>
<td>32</td>
<td>1.20</td>
<td>0.6</td>
<td>high barrier, deep draw</td>
</tr>
<tr>
<td>EF-E</td>
<td>Non-oriented</td>
<td>30</td>
<td>44</td>
<td>1.14</td>
<td>1.0</td>
<td>sealable, deep draw</td>
</tr>
<tr>
<td>VM-XL</td>
<td>Biaxially oriented, Aluminium metalized.</td>
<td>15</td>
<td>32</td>
<td>1.20</td>
<td>&lt;0.05</td>
<td>ultra-high barrier</td>
</tr>
<tr>
<td>HF-M</td>
<td>Non-oriented</td>
<td>12</td>
<td>-</td>
<td>1.10</td>
<td>-</td>
<td>matt for wallpaper use</td>
</tr>
</tbody>
</table>

Gas barrier properties of EVAL™

EVAL™ gas barrier performance is affected by humidity and temperature, but even in extreme conditions it offers exceptional barrier properties.

What is important is the equilibrium relative humidity of the EVAL™ layer itself. EVOH is a hydrophilic polymer. But as an EVAL™ layer loses any humidity it may have absorbed, the barrier performance improves.

TRANSMISSION RATES OF OTHER GASES AT 0% RH (cm³.20µm/m².day.atm)

<table>
<thead>
<tr>
<th>Film type</th>
<th>H₂ (20°C)</th>
<th>N₂ (25°C)</th>
<th>CO₂ (25°C)</th>
<th>He (25°C)</th>
<th>Ar (35°C)</th>
<th>Ar (50°C)</th>
<th>Kr (35°C)</th>
<th>Kr (50°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>F101B</td>
<td>30*</td>
<td>0.017</td>
<td>0.81</td>
<td>160</td>
<td>-</td>
<td>0.5</td>
<td>-</td>
<td>0.4</td>
</tr>
<tr>
<td>E105B</td>
<td>200</td>
<td>0.13</td>
<td>7.1</td>
<td>410</td>
<td>1.6</td>
<td>7.0</td>
<td>-</td>
<td>1.8</td>
</tr>
<tr>
<td>OPA</td>
<td>-</td>
<td>12</td>
<td>205</td>
<td>2,000</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CPA</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>60</td>
<td>150</td>
<td>23</td>
<td>68</td>
</tr>
<tr>
<td>OPET</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3,100</td>
<td>28,000</td>
<td>6,900</td>
<td>23,000</td>
</tr>
<tr>
<td>OPP</td>
<td>10,000</td>
<td>730</td>
<td>9,100</td>
<td>-</td>
<td>8,100</td>
<td>28,000</td>
<td>6,900</td>
<td>23,000</td>
</tr>
<tr>
<td>LDPE</td>
<td>-</td>
<td>3,100</td>
<td>42,000</td>
<td>28,000</td>
<td>19,000</td>
<td>46,000</td>
<td>25,000</td>
<td>74,000</td>
</tr>
</tbody>
</table>

*F171B
Resistance of EVAL™ to various organic solvents

<table>
<thead>
<tr>
<th>Solvent</th>
<th>SP value (cal/m³)</th>
<th>Weight increase (wt%)</th>
<th>20°C, 1 month</th>
<th>20°C, 6 months</th>
<th>20°C, 1 year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SP = Solubility parameter</td>
<td>F101B</td>
<td>PA6</td>
<td>F101B</td>
<td>PA6</td>
</tr>
<tr>
<td>Xylene</td>
<td>8.8</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.8</td>
</tr>
<tr>
<td>Ethylacetate</td>
<td>9.1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Benzene</td>
<td>9.2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.8</td>
</tr>
<tr>
<td>Acetone</td>
<td>9.9</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.6</td>
</tr>
<tr>
<td>Pyridine</td>
<td>10.7</td>
<td>0.5</td>
<td>0</td>
<td>0.3</td>
<td>1.2</td>
</tr>
<tr>
<td>Ethanol</td>
<td>12.7</td>
<td>1.5</td>
<td>5.2</td>
<td>2.0</td>
<td>12.0</td>
</tr>
<tr>
<td>Salad oil</td>
<td>-</td>
<td>0</td>
<td>0</td>
<td>0.04</td>
<td>-</td>
</tr>
</tbody>
</table>

Measurement conditions: swelling method. SP value of EVAL™ F = 19.0; the SP value of PA6 = 12.7. For best results, the difference between the material and solvent SP values should be as large as possible.

EVAL™ barrier against solvent permeation

<table>
<thead>
<tr>
<th>Film type</th>
<th>Chloroform</th>
<th>Xylene</th>
<th>Methyl ethyl ketone</th>
<th>Kerosene</th>
</tr>
</thead>
<tbody>
<tr>
<td>EVAL F</td>
<td>0.20</td>
<td>&lt;0.04</td>
<td>0.09</td>
<td>&lt;0.04</td>
</tr>
<tr>
<td>EVAL E</td>
<td>0.21</td>
<td>&lt;0.06</td>
<td>0.13</td>
<td>&lt;0.06</td>
</tr>
<tr>
<td>OPA</td>
<td>16.9</td>
<td>1.19</td>
<td>3.38</td>
<td>0.48</td>
</tr>
<tr>
<td>OPP</td>
<td>3740</td>
<td>350</td>
<td>12</td>
<td>53</td>
</tr>
<tr>
<td>LDPE</td>
<td>6900</td>
<td>813</td>
<td>185</td>
<td>190</td>
</tr>
</tbody>
</table>

Unit: g·20μm/m²·day·atm

EVAL™ resists flavour absorption

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
<th>Flavours</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flavour absorption</td>
<td>ppm</td>
<td>d-Limonene</td>
<td>EF-E</td>
</tr>
<tr>
<td>(liquid)</td>
<td></td>
<td>280</td>
<td>1,480</td>
</tr>
<tr>
<td></td>
<td></td>
<td>n-Butyl acetate</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ethyl acetate</td>
<td>&lt;50</td>
</tr>
<tr>
<td></td>
<td>mg/g</td>
<td>1-Methol</td>
<td>0.2</td>
</tr>
<tr>
<td>Flavour absorption</td>
<td></td>
<td>Salicylic acid methyl</td>
<td>1.7</td>
</tr>
<tr>
<td>(gas)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Adjusting structure design for optimal performance

Based on the application and typical conditions of use, it is possible to optimise barrier performance. The equilibrium relative humidity of the EVAL™ layer can be lowered by shifting its location or by carefully choosing the other materials in the structure.
Applications in Food Packaging

Flexible (blown, cast, lamination)

Extended freshness and protected value

Fresh meat shrink wrap
PA/EVAL™/PA/tie/PE
outside inside

Sliced ham
PET/tie/EVAL™/PA/tie/EVA
outside inside

MAP with long-lasting gas mix
PET/PE/tie/EVAL™/tie/EVA
outside inside

Al foil-free for safety and reduced environmental impact

Ultra efficient bag-in-box liner
PE/tie/EVAL™/tie/EVA
outside inside

Al foil-free aroma barrier
PET/PE/tie/EVAL™/tie/PE
outside inside

Transparent barrier lid film
PA/EVAL™ film/PP
outside inside

Affordable UHT milk pouch
PE/tie/EVAL™/tie/PE
outside inside

Affordable soup powder sachet
Paper/PE/tie/EVAL™/tie/PE
outside inside

Transparent packs for sensitive foods
OPP/EVAL™ film/PE
outside inside
Rigid (tray, cup, bottle, tube)

**Thermoforming to replace metal cans and trays**

- **Baby food**
  - PP/tie/EVAL™/tie/PP
  - Outside: inside

- **Pet food tray**
  - PP/tie/EVAL™/tie/PP
  - Outside: inside

- **Deep draw beverage “can”**
  - PS/tie/EVAL™/tie/PS
  - Outside: inside

**Improving safety, shelf life without conservatives**

- **Metal replacement, no sharp edges**
  - PE/tie/EVAL™/tie/regrind/PE
  - Outside: inside

- **Shelf-stable dairy**
  - PE/tie/EVAL™/tie/PE
  - Outside: inside

- **Freshness without conservatives**
  - PE or PP/tie/EVAL™/tie/PE or PP
  - Outside: inside

**High quality packaging, protecting valuable ingredients**

- **Seamless coextruded tube**
  - PE/tie/EVAL™/tie/PE
  - Outside: inside

- **Glossy, printable exterior layer**
  - EVAL™/tie/PP
  - Outside: inside

- **Barrier guaranteed vitamin content**
  - PE/tie/EVAL™/tie/PE
  - Outside: inside
Coating (paperboard, paper)

Adding barrier function to renewable materials

Aroma barrier paper sachet
Paper/PE/tie/EVAL™/tie/PE
outside inside

Migration barrier paper liner
Paper/PE/tie/EVAL™/tie/PE
outside inside

Al-free carton for liquids
PE/paper/PE/tie/EVAL™/tie/PE
outside inside

New technologies that boost packaging shelf appeal

Coinjected barrier can
PP/EVAL™/PP/EVAL™/PP
outside inside

Barrier in-mould label cup
PE/tie/EVAL™/tie/PE/PE
outside inside

Ultralight tomato sauce pouch
PET/PE/tie/EVAL™/tie/PE
outside inside

Applications in Medical and Pharmaceutical

Ensuring product integrity and protection from contamination

Sealable medicine sachet
PET/AL/EVAL™ film
outside inside

Nutrition provided intact
PE/tie/EVAL™/tie/PE
outside inside

Visibility and protection
PET/PE/tie/EVAL™/tie/PE
outside inside
Applications in Building and Construction and Fuel containment

Extended energy efficiency and service life

- Underfloor heating pipe
  EVAL™/tie/PEX
  outside inside

- VOC barrier construction membranes
  PE/PE/tie/EVAL™/tie/PE/PE
  outside inside

- Preinsulated pipe
  PE/tie/EVAL™/PUR foam/EVAL™/tie/PEX
  outside inside

- Vacuum insulation panels
  Film/Film/EVAL™ film/sealant
  outside inside

- Durable and stain-resistant wallpaper
  EVAL™ film/PVC/paper
  outside inside

- Fuel tanks, lines and filler pipes
  PE/tie/EVAL™/tie/PE
  outside inside

Applications in Agriculture

Fewer chemical emissions, less waste of farm produce

- TIF much films
  PE/PE/tie/EVAL™/tie/PE
  outside inside

- Chemical and solvent resistant bottles
  PE/tie/EVAL™
  outside inside

- Barrier IBC
  PE/tie/EVAL™/tie/PE
  outside inside
Open innovation

Application development with the world’s barrier experts

Kuraray is a world leader in specialty chemicals and functional materials. We are committed to developing products that ensure quality and value while helping our business partners differentiate themselves from their competition.

Kuraray Co. Ltd. was the first company in the world to produce and commercialise EVOH, starting in Okayama, Japan in 1972. Today Kuraray is the world’s largest producer of Vinyl Acetate Monomer derivatives, and is still the leader in EVOH technology, production, structure analysis and technical development.

EVAL™ production began in Houston, USA in 1986, and in Antwerp, Belgium in 1999.

Technical centres were established in Kurashiki, Japan, at the Houston and Antwerp production sites, and in Singapore. At each site we work together with converters and end users, bringing our expertise in barrier technology and structure optimisation.

To learn more about our open innovation development, visit our global website www.evalevoh.com
NOTICE

The information, specifications, procedures, methods and recommendations herein are presented in good faith, are believed to be accurate and reliable, but may well be incomplete and/or not applicable to all conditions or situations that may exist or occur. No representation, guarantee or warranty is made as to the completeness of said information, specifications, procedures, methods and recommendations or that the application or use of any of the same will avoid hazards, accidents, losses, damages or injury of any kind to persons or property or that the same will not infringe patents of others or give desired results. Readers are cautioned to satisfy themselves as to the suitability of said information, specifications, procedures, methods and recommendations for the purpose intended prior to use.