

# Properties and Usages of Polyvinylidene Chloride

---

# PVDC

---

**Coated Film**      **Ver. 2**

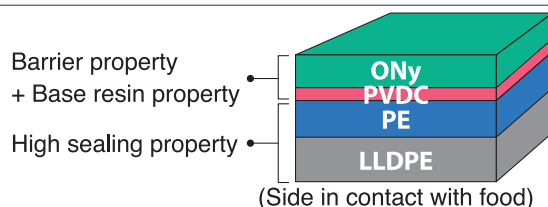
# Properties and usages of polyvinylidene chloride (PVDC) - coated film

## 1 What is PVDC-coated film?

PVDC-coated film is made by coating OPP or other types of base film with a very thin (1 to 3 μm) layer of PVDC. It is used widely both in Japan and overseas as a packaging material that provides moisture-proofing and gas-barrier properties in addition to the properties of the base film.

## 2 Layer composition of PVDC-coated film

The figure on the right shows an example of film layer composition. A heat-seal layer (e.g., PE film) is also laminated between the PVDC-coated layer and packaged food.



## 3 Terms

Abbreviation	Name
PVDC	Polyvinylidene Chloride
PET	Polyethylene terephthalate
PVC	Polyvinyl chloride
LLDPE	Linear low density polyethylene
OPP	Biaxially Oriented Polypropylene

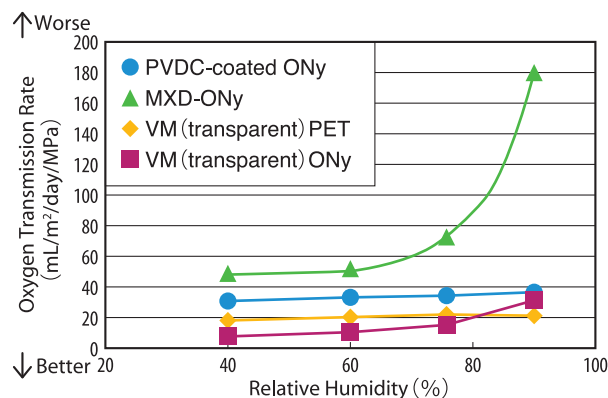
Abbreviation	Name
ONy	Biaxially Oriented Nylon
PE	Polyethylene
PVA	Polyvinyl alcohol
VM	Vacuum Metallizing

## 4 Major characteristics of PVDC-coated film

### (1) Characteristics

#### 1) Low dependency of the oxygen barrier property on humidity

As PVDC-coated film has a high oxygen gas barrier property and maintains almost constant oxygen gas permeability under any humidity environment, it can suppress the oxidation of food.



#### 2) Additional moisture-barrier property

The improved moisture-barrier property of PVDC can suppress the drying or moisture absorption of food.

Moisture loss rate of food (unit %)

30°C × 40%RH

Days	PVDC-coated ONy		ONy
	ONy (15μm)	PVDC-coated (2μm) / LLDPE (50μm)	ONy (15μm) / LLDPE (50μm)
0		0	0
7		0.4	1.2
14		0.8	2.5
21		1.2	2.8
28		1.6	5.1

### 3) Excellent aroma retaining property

No odor leaks from PVDC-coated OPP and ONy film packages containing vinegar even after one month, indicating a higher aroma retaining property compared with other gas-barrier film products. Since many food products (e.g., snacks, sauces, mayonnaise, driedkelp flakes, pickled red ginger roots) contain vinegar, the high aroma retaining property is considered an advantage of PVDC-coated film.

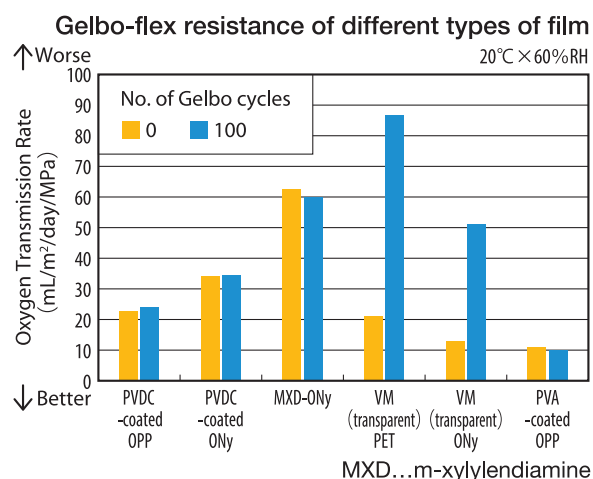
Aroma retaining property test results for different types of film (Content: Vinegar)

Days	PVDC-coated OPP	PVDC-coated ONy	VM(transparent)PET	VM(transparent)ONy	PVA-coated OPP
1	1	1	1	1	1
2	1	1	1	2	1
7	1	1	1	1	3
14	1	1	1	4	4
21	1	1	1	5	5
28	1	1	2	5	5

Evaluation criteria : No odor leakage : 1 → 3 → 5 : Odor leakage

### 4) High flex resistance

PVDC-coated OPP and ONy film products have a high flex resistance property thanks to the oxygen/gas barrier property of the high-ductility PVDC polymer. The flex resistance property is important during the processing (printing, laminating) of packaging materials and in the transportation stage of packaged food.



## (2) Comparison of the characteristics of different types of barrier film

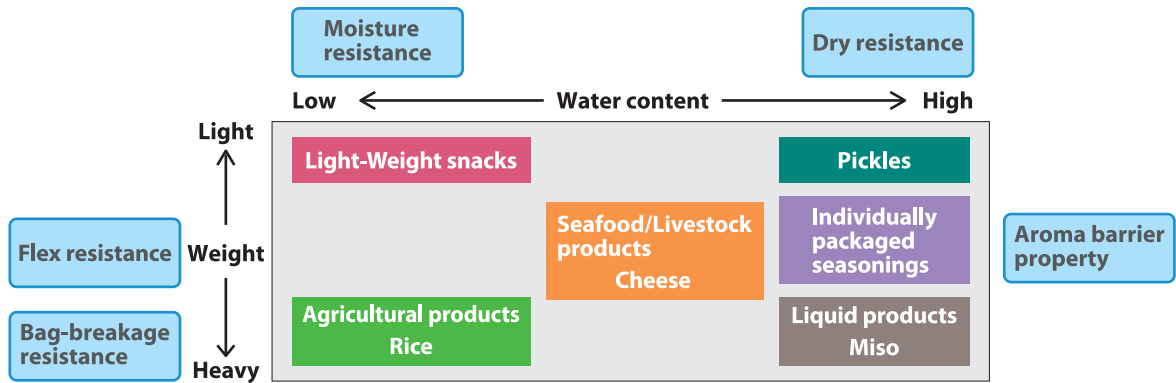
The table below summarizes the characteristics of different types of transparent barrier film. PVDC-coated film displays excellent performance regarding gas barrier, humidity dependency, aroma retaining and flex resistance properties.

Items	PVDC-coated OPP	PVDC-coated ONy	MXD · ONy	VM (transparent) PET	VM (transparent) ONy	PVA-coated OPP
Oxygen gas-barrier property	○	○	○	◎	◎	◎~○
Humidity dependency of oxygen gas-barrier property	○	○	△	○	△	×
Moisture-barrier property	○	△	×	◎	○	○
Aroma retaining property	○	○	×	○	△	△
Flex resistance property	○	○	○	×	×	○
Pinhole resistance property	△	◎	○	△	◎	△

## 5 Examples of usage

### (1) Packaged food and base materials for coating

The relation between the water content, weight of packaged food and required packaging performance is as shown below.



Major usages of base materials for PVDC coating are as listed below.

Base material for coating	Major usages
PVDC-coated OPP	Packaging of light-weight products
PVDC-coated PET	Seafood, livestock products, stand-up pouch
PVDC-coated ONy	Liquid packaging, food packaging for industrial use, retort pouch
PVDC-coated PVC	Blister-packed pharmaceutical products

### (2) Examples of usage in Japan




#### 1) PVDC-coated OPP

This type of film is mainly used for the packaging of light-weight products.

<p><b>For moisture-proofing</b> Rice snacks, Biscuits, Pocket warmers, etc.</p>	
<p><b>For high water-content products</b> Pickles, Simmered food, Boiled convenience food, Boiled bamboo shoots, etc.</p>	

## 2) PVDC-coated ONY

This type of film is used as a material suitable for the packaging of heavy-weight products that require pinhole and bag-breakage resistance properties.

<p><b>For moisture-proofing</b> Agricultural products, Dried products, Dried sweet potatoes, Large bags of chicken nuggets, Food boiled in soy sauce, etc.</p>	 <p>Dried sweet potatoes</p>	 <p>Chicken nuggets</p>	 <p>Clams boiled in soy sauce</p>
<p><b>For pinhole resistance</b> Sausages, Rice cake, Western and Japanese-style confectionery, Semi-dried noodles, etc.</p>	 <p>Sausages</p>	 <p>Squarely cut rice cake 360g</p>	 <p>Sponge cakes</p> <p>Sponge cake</p>
<p><b>For liquid packaging/ bag-breakage resistance</b> Liquid soup, Individually packed Seasonings, Miso, Rice, etc.</p>	 <p>Individually packed seasonings</p>	 <p>Miso</p>	 <p>Rice 5kg</p> <p>Rice</p>

## (3) Examples of usage in non-Japan

### 1) PVDC-coated OPP

This type of film is used widely for light-weight snacks, dried food, bean snacks and other products.

<p><b>For moisture-proofing</b> Dried food, Snacks, Baked food, Pocket warmers, etc.</p> <p><b>For drying prevention</b> Wonton wrappers, etc.</p>	 <p>Dried fruit</p>	 <p>Peanut</p> <p>Bean snacks</p>
--	--	--

## 2) PVDC-coated PET

The use of this type of film is increasing for stand-up-pouched food and other products, in addition to processed seafood and cheese.

**For moisture-proofing**  
Snacks, Dried food,  
Pet food, Chicken nuggets,  
etc.

**For drying prevention**  
Smoked salmon, Cheese,  
Mooncakes, Tortillas,  
Omelet rolls, Cookies etc.

**For boiling/  
retort-packing**  
Retort-pouched food,  
etc.

The image shows four examples of products in PVDC-coated PET packaging: a stand-up pouch of Smoked Salmon, a stand-up pouch of Cheese, a stand-up pouch of Tortillas, and a stand-up pouch of Mooncakes. Each product is shown with a label below it: 'Processed seafood', 'Cheese', 'Mooncakes', and 'Tortillas'.

## 3) PVDC-coated ONy

This type of film is used as a material suitable for the packaging of heavy-weight products that require a bag-breakage resistance property.

**For moisture-proofing**  
Dried meat, etc.

**For high water  
-content products**  
Pickles, etc.

**For bag-breakage  
resistance**  
Tomato sauce, Curry paste,  
Salad dressing, etc.

The image shows three examples of products in PVDC-coated ONy packaging: a large bag of Tomato Sauce, a large bag of Pickles (labeled with Japanese characters '榨菜'), and a large bag of Curry Paste. Each product is shown with a label below it: 'Tomato sauce', 'Pickles', and 'Curry paste'.

## 4) PVDC-coated PVC

This type of film is used for the blister-packing of pharmaceutical products (capsules, tablets).

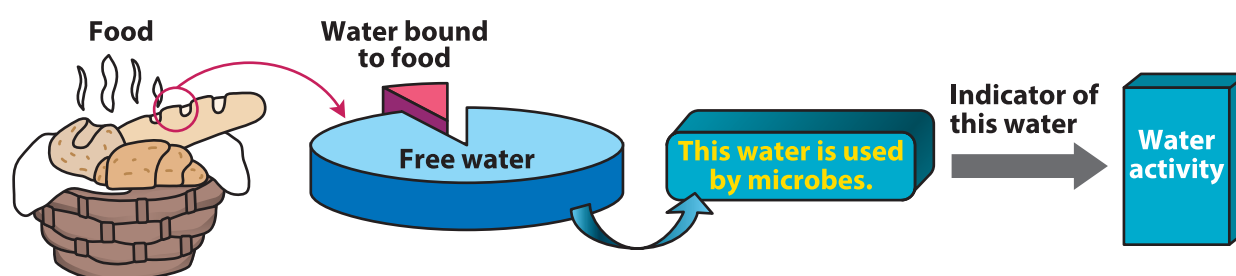
**For blister-packing**  
Capsules/Tablets of  
pharmaceutical products,  
etc.

The image shows two examples of pharmaceutical products in PVDC-coated PVC blister packaging: a blister pack containing capsules and a blister pack containing tablets. Each product is shown with a label below it: 'Capsules' and 'Tablets'.

## 6 Water activity in food and PVDC-coated film

Moisture content in food can be divided into “bound water” that is bound to protein and carbohydrate and “free water” that can evaporate from or move freely in food. Microbes can only use free water in food for propagation. Water activity ( $A_w$ ) is used as the indicator of the ratio of free water.

Water activity is expressed with the formula  $A_w = P/P_0$ , where  $P_0$  is the vapor pressure of pure water at a certain temperature and  $P$  is the vapor pressure in a sealed container containing food.



High water activity food tends to be more susceptible to oxidative deterioration. Therefore, PVDC-coated film, which has an oxygen barrier property and can withstand humidity changes, is used for such food.

### Examples of high water activity food

Food category	Water content(%)	Water activity	Food category	Water content(%)	Water activity
Vegetables	>90	0.99~0.98	Ham/Sausage	65~56	0.90
Meat	>70	0.98~0.97	Salami sausage	30	0.81
Fruit juice	88~86	0.97	Salt-fermented squid	64	0.80
Deep-fried fish paste	76~72	0.96	Jam	30	0.80~0.75
Cheese	53~35	0.99~0.94	Soy sauce	70	0.81~0.76
Bread	35	0.96~0.93	Miso	46~42	0.80~0.70

Source : Food Microbiology Handbook

Conversely, low water activity food changes in quality by absorbing water from the outside. Therefore, it is required for packaging materials to be vapor resistant, and PVDC-coated film is widely used for this type of food.

### Examples of medium/low water activity food

Food category	Water content(%)	Water activity	Food category	Water content(%)	Water activity
Honey	16	0.75	Crackers	5	0.53
Cakes	25	0.74	Dried noodles	10	0.50
Dried fruit	17~15	0.72~0.65	Biscuits	4	0.33
Jelly	18	0.69~0.60	Chocolate	1	0.32
Dried shrimp	23	0.64	Green tea	4	0.26
Stored rice	14~13	0.64~0.60	Dried vegetables	5	0.20

Source : Food Microbiology Handbook