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Attractive protection for your food

Chlorine-free water-borne barriers

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EXCEVAL™ - the solution for barrier requirements

EXCEVAL™ is the trademark of Kuraray's chlorine-free barrier resin, especially designed for the requirements of the barrier coating industry. The new Ethylene-Modified copolymer is water-soluble like standard polyvinyl alcohol. However, coatings made of **EXCEVAL™** absorb significantly less humidity at average temperature conditions.

Therefore, **EXCEVAL™** provides coatings with excellent gas barriers, e.g. towards oxygen, nitrogen and carbon dioxide – even at elevated relative humidity. Furthermore, the resulting coatings are highly transparent and glossy, have a strong chemical resistance, and provide good adhesion to metal as well as excellent printability.

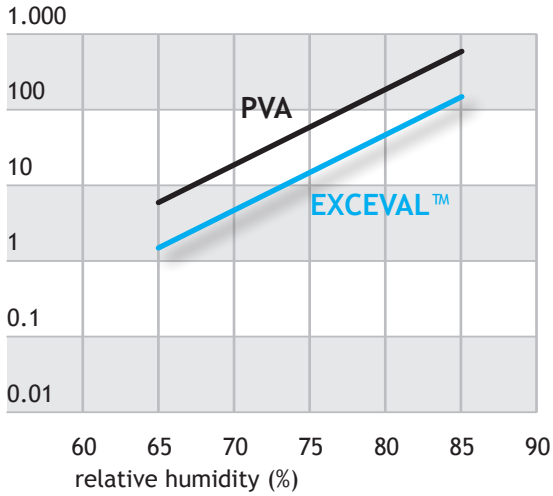
Applications devised for your product

EXCEVAL™ enables a barrier of less than 1 $cm^3 \cdot m^{-2} \cdot day^{-1} \cdot atm^{-1}$ (very high oxygen barrier) even at high degrees of relative humidity. **EXCEVAL™** can be applied as a solvent free, chlorine-free and environmentally-friendly waterborne coating on numerous substrates and provides superior barrier level compared to traditional coatings.

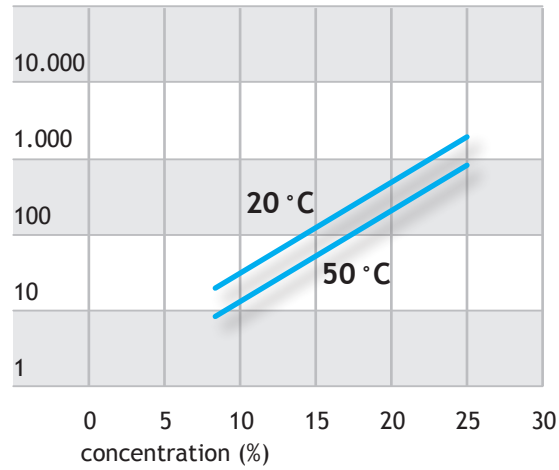
Because of the need to control gas and water vapour permeation simultaneously while providing mechanical performance, the structure of a packaging film will consist of several layers, each of them contributing to one or several properties of the film construction. A base layer that may be constituted of polyolefin materials, have low water vapour permeation and also providing some mechanical resistance will be combined with an **EXCEVAL™** oxygen barrier layer. In such a structure there are also further layers that provide specific functionalities like primers, adhesives, inks, etc.

EXCEVAL™ - Performance that is simply convincing

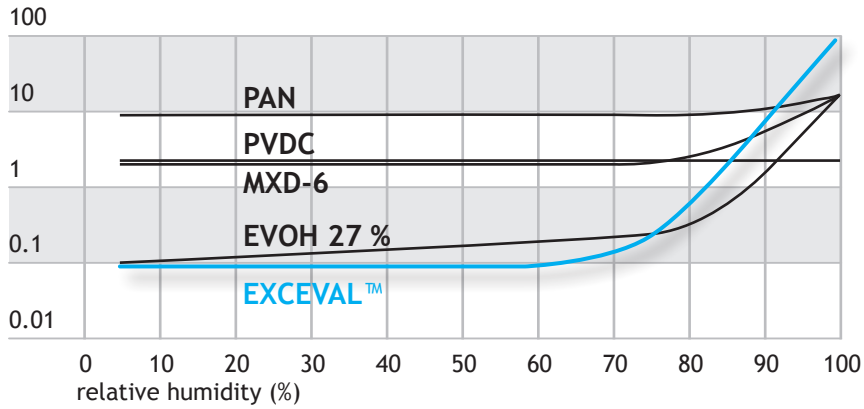
Oxygen Transmission Rate
of **EXCEVAL™** compared to standard polyvinyl alcohol
at 20 °C, $cm^3.2\mu m \cdot m^{-2} \cdot day^{-1} \cdot atm^{-1}$



Viscosity
of low-viscous **EXCEVAL™** grades
Viscosity (mPa·s)



Oxygen Transmission Rate
of **EXCEVAL™** compared to standard barrier coating materials at 20 °C,
$cm^3.20\mu m \cdot m^{-2} \cdot day^{-1} \cdot atm^{-1}$



The Oxygen Transmission Rate
of a PE film coated with **EXCEVAL™** and metallised is analysed at 23 °C,
65 % RH, in 100 % Oxygen atmosphere:

Oxygen Transmission Rate $cm^3 \cdot m^{-2} \cdot day^{-1} \cdot atm^{-1}$	Initial	After 20 Cycles Gelbo-Flex-Test
Towards O_2-Side	< 0.1	< 0.1
Towards N_2-Side	< 0.1	< 0.1

EXCEVAL™ shows outstanding performance as gas barrier layer – even after 20 torsions of the film.

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EXCEVAL™ - Frequently asked questions

How to dissolve EXCEVAL™?

EXCEVAL™ should be dispersed in cold water and then be heated to 95°C inner temperature and kept there for 2 hours. The solution should then be cooled down slowly.

Storage of EXCEVAL™ solutions!

Upon storage at low temperature an EXCEVAL™ solution may gel. Storage at elevated temperature as well as addition of isopropanol (IPA) will reduce the gelling tendency.

How can possible foaming of EXCEVAL™ solutions be prevented during solving and application?

Adding 10% isopropanol to Exceval will considerably reduce the foam formation in the dissolving vessel. The subsequent addition of IPA reduces the foam formation on the gravure rolls. IPA will also significantly improve the wetting of EXCEVAL™ on the plastic substrate. Furthermore, reducing the viscosity of the EXCEVAL™ solution contributes to a reduction of the foam formation on the gravure rolls.

How can I increase the coat weight?

Increasing the coating temperature will reduce the viscosity. Depending on the coating temperature the total solid content can be adjusted. By increasing the solid content the drying time can be reduced.

What total solid content can I prepare?

Typically a 10-15% solution should be made.

At what temperature do I need to dry?

No specific temperature is needed as EXCEVAL™ solutions are forming a film upon drying. In contrast, PVDC needs elevated temperatures to enable particles coalescing to form a film.

How much material is required to achieve a high gas barrier level?

A dry weight of 1-2µm is enough to achieve a high gas barrier level (permeation less than 1 $cm^3 \cdot m^{-2} \cdot day^{-1} \cdot atm^{-1}$).

How do I improve the barrier properties?

Crystallisation is the driving force behind the barrier performance of EXCEVAL™. Any temperature treatment will improve the barrier performance. Storage of the coated film at elevated temperatures (50°C for several days) will allow the improvement of the gas barrier level.

How to improve the water resistance?

Crosslinking will improve the water resistance; however, the crosslinking ratio will reduce the barrier performance. A metal binding complex is preferred in order to combine good water resistance while maintaining the excellent barrier level.

Can I print on EXCEVAL™?

Yes, it has a very good affinity printing inks.

Does torsion affect barrier performance?

To estimate the flexibility of the packaging film, the barrier properties are evaluated before and after mechanical torsion (Gelbo Flex test). Even after 20 torsions EXCEVAL™ barriers demonstrate outstanding performance.

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EXCEVAL™ - designed to preserve the good taste

Non-metallised films applications

Packaging films preserve a wide range of various food. Typically 2-layer constructions of PE, PP, PET and PA are used in the food industry – among other things for confectionery, bread, frozen meat products, rice and cereal products. Most of these materials are supplied as finished films with Flexo-printing. A thin layer of **EXCEVAL**™ of less than a few µm is coated directly with or without primer on these different substrates. In order to protect **EXCEVAL**™ from humidity, **EXCEVAL**™ can be top-coated or laminated with substrates that have low water vapour permeation. PE is used mainly used as welding layer in this construction. Other typical applications of transparent barrier films are, for example, lids to closed food trays.

Keeping it crisp and aromatic:
***EXCEVAL™** coatings provide excellent protection for fresh food.*

Metallised film applications

Metallised film such as PET, SiOx-coated PET and new high-barrier metallised BOPP are used in a wide variety of food packaging applications where either a high barrier or striking appearance is required, for example, in crisp packaging (BOPP) or coffee packaging. In addition, vacuum-metallised papers are employed as liners for cigarettes, packaging for pharmaceutical products, dairy products, confectionery and gift wrapping, wet glue label and outer liner for carton.

Pinholes in a metallised substrate are the main pathway for permeation. Pinholes account for the majority of the oxygen permeation but only for about 20% of the water vapour permeation. Most of the water vapour permeation through a metallised layer is due to nano-scale defects on the surface.

The main way to improve the gas barrier properties of such a construction is to perform the metallisation on top of a polymeric gas barrier layer like **EXCEVAL**™. With **EXCEVAL**™ the pinholes will be filled with this polymeric gas barrier substrate and consequently the overall gas barrier performance of the metallisation increases significantly. Furthermore, the use of **EXCEVAL**™ as a polymeric gas barrier layer will avoid the necessity of performing a second metallisation process that contributes significantly to the deterioration of the flexibility of the packaging film.

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Adding value to your products - worldwide

KURARAY POVAL™, EXCEVAL™, ELVANOL™ and MOWIFLEX™ are the trademarks for polyvinyl alcohols made by Kuraray. Their key characteristics – outstanding film-forming properties and high binding strength – add real value to your products. Our polymers are water-soluble, highly reactive, crosslinkable and foamable. They have high pigment binding capacity, protective colloid characteristics and thickening effects. The physical and chemical properties of KURARAY POVAL™ make it ideal for a wide variety of applications, ranging from adhesives through paper and ceramics to packaging films. Many of our polymers are food contact-approved and thus suitable for food applications. Ecologically KURARAY POVAL™ is advantageous due to its biodegradability and the fact that combustion does not generate residues. It is available in various particle sizes from granules to fine powders.

Kuraray produces its wide range of KURARAY POVAL™ grades in Japan, Singapore, Germany and the USA. Kuraray's global production and service network make us your partner of choice for innovative high-quality PVOH resins.

KURARAY - Here to Innovate.

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