

HIGH PERFORMANCE POLYMERS **POLYAMIDES FILM GRADE**

RadiciGroup High Performance Polymers has developed a Radilon® family of products specifically for extrusion and film manufacturing. The new materials meet the requirements of a market that is increasingly demanding with respect to both the final products and processing technologies.

RadiciGroup's upstream vertical integration enables full control over the design of these special materials from the very beginning, that is, from the polymerization stage at the RadiciGroup Specialty Chemicals polyamide production plants.



Polyamide functions

In packaging film, the polyamide layer performs two crucial functions:

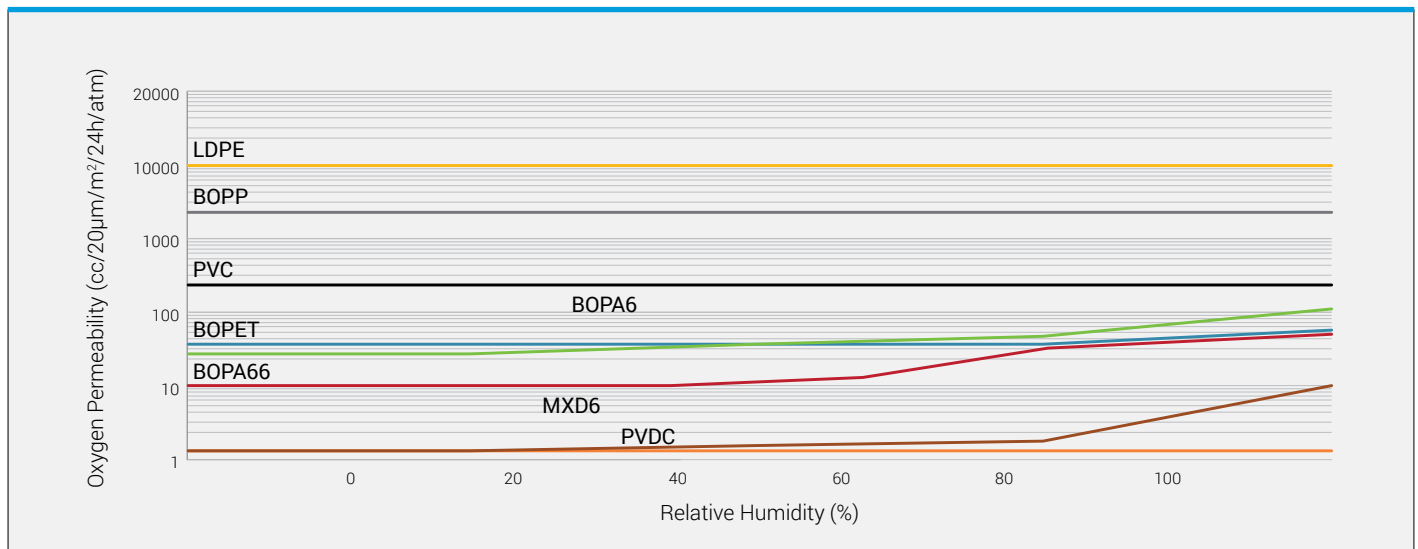
- It delays the deterioration of packaged foods by creating a barrier that considerably slows down the rate of oxygen migration into the packages.
- It reduces to a minimum the migration of food aromas from the package, thus ensuring long conservation of the food's organoleptic properties.

In film manufacturing, the polyamide layer is usually combined with layers of polythene or polythene copolymers to create a multilayer film that provides an effective seal against moisture, whilst ensuring good transparency.

Graph below shows the oxygen permeability values for a few polymers used in the manufacture of film. The gas barrier properties of polyamides are excellent, and they are even better for biaxially oriented polyamide 6 and 6.6.

Polyamides are used in packaging materials when characteristics in addition to good barrier properties are required, such as:

- Mechanical Strength
- Toughness
- Transparency
- Thermo-formability
- Puncture resistance
- Heat resistance



RadiciGroup High Performance Polymers product range

Film-grade polyamides are sold by RadiciGroup High Performance Polymers under the Radilon® brand name. Film extrusion grades are available in a wide range of viscosities and crystallization speed, including copolyamides with different melting points.

PRODUCT RANGE	
RADILON®	POLYMER
Radilon® S	PA 6
Radilon® CS and CA	Copolyamides
Radilon® A	PA 6.6
Radilon® D	PA 6.10
Radilon® DT	PA 6.12

Thanks to the flexibility of its production plants, RadiciGroup High Performance Polymers can supply its customers with specific grades that cover different needs such as:

- Products requiring different viscosity grades
- Products requiring enhanced lubrication
- Products requiring different crystallization level

Everything is done to meet the needs of the various application sectors. Furthermore, RadiciGroup High Performance Polymers is available to design tailored products for special requirements that are not covered by the products already in the current line.

RADILON® FILM GRADE PROPERTIES

PROPERTIES	METHOD	UNIT	S 32F	S 35L	S 35FL	S 40L	CS 34FL	CS 38FL	CS 38TX
Melting point	ISO 11357-1	°C	222	222	222	222	190	190	205
Viscosity Number	ISO 307	ml/g	185	200	200	245	195	230	230
Density	ISO 1183	Kg/m ³	1140	1140	1140	1140	1120	1120	1120
Moisture content	ISO	%	<0,06	<0,06	<0,06	<0,06	<0,06	<0,06	<0,06
O ₂ Transmission rate	23°C / 0% r.h. 50µm	ml/m ² .day.bar	26	26	26	26	24	24	-
CO ₂ Transmission rate	23°C / 0% r.h. 50µm	ml/m ² .day.bar	85	85	85	85	130	130	-

RADILON® FILM GRADE PROPERTIES

PROPERTIES	METHOD	UNIT	CA 27	A 42K	A 42	A 38	D 38	DT 38
Melting point	ISO 11357-1	°C	245	260	260	260	220	197/207
Viscosity Number	ISO 307	ml/g	146	260	260	230	230	230
Density	ISO 1183	Kg/m ³	1120	1140	1140	1140	1070	1060
Moisture content	ISO	%	<0,06	<0,06	<0,06	<0,06	<0,06	<0,06
O ₂ Transmission rate	23°C / 0% r.h. 50µm	ml/m ² .day.bar	-	26	26	26	100	90
CO ₂ Transmission rate	23°C / 0% r.h. 50µm	ml/m ² .day.bar	-	85	85	85	10	6

The main processes for the manufacture of packaging film are cast bi-oriented extrusion or blown extrusion. In cast extrusion, the most commonly used polyamides are Radilon® S homopolymers, for which extrusion thickness normally varies from 20 microns to 100 microns.

In this case, the choice of the right Radilon® grade for a given technology is essential, but also very important are the cooling process and the crystallization speed, which together can determine the quality of the finished film in terms of transparency and mechanical strength. In blown extrusion, products from all the Radilon® grades S, CS and A.

Generally speaking, the CS (copolyamide) grade is the preferred choice if it is to be coextruded with PE, because it gives the film enhanced transparency, better thermoformability and improved adhesion between layers.

Radilon® D

A new family of semi-crystalline polyamides 6.10 obtained from the polycondensation of 1,6-hexamethylene diamine and 1,10-decanedioic acid (sebacic acid). Sebacic acid is extracted from castor oil: a natural raw material obtained from the seeds of castor oil plant.

Radilon® D bio-based polyamide 6.10 family contains about 60% of raw material that come from renewable sources. It is compounded at various plastic production sites or alternatively used in fiber and plastic film market.



Figure 1 | Castor oil seeds and plant

MAIN APPLICATIONS

PRODUCTS

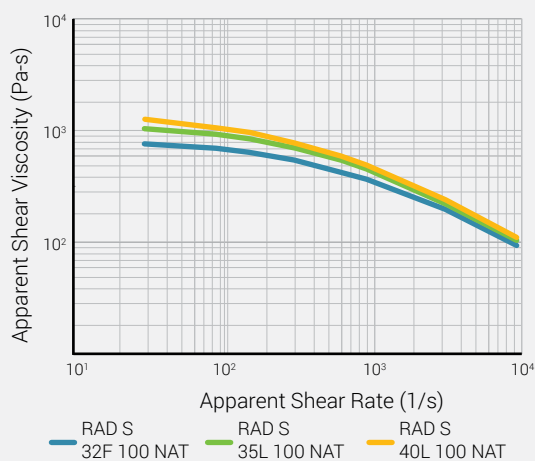
APPLICATIONS

S 32F	PA6 low viscosity	Extrusion and coextrusion coating and monofilaments
S 35L	PA6 medium viscosity	Mono blown and cast coextrusion film - general purpose
S 35FL	PA6 medium viscosity	Cast / blown film and coextrusion BOPA film
S 40L	PA6 high viscosity	Mono blown and cast coextrusion film - general purpose
CA 27	PA6.6 low viscosity	Multilayer blown and cast films
CS 34FL	PA6.66 medium viscosity	Multilayer blown and cast films
CS 38FL	PA6.66 high viscosity	Multilayer blown and cast films
CS 38 TX	PA6.66 high viscosity	Multilayer blown and cast films
A 42	PA6.6 high viscosity	Blown mono / multi layer and monofilament
A 42K	PA6.6 high viscosity	Blown mono / multi layer / shrink casing and bags
A 38	PA6.6 high viscosity	Blown mono / multi layer and monofilament
D 38	PA6.10 high viscosity	Blown mono / multi layer and monofilament
DT 38	PA6.12 high viscosity	Blown mono / multi layer and monofilament

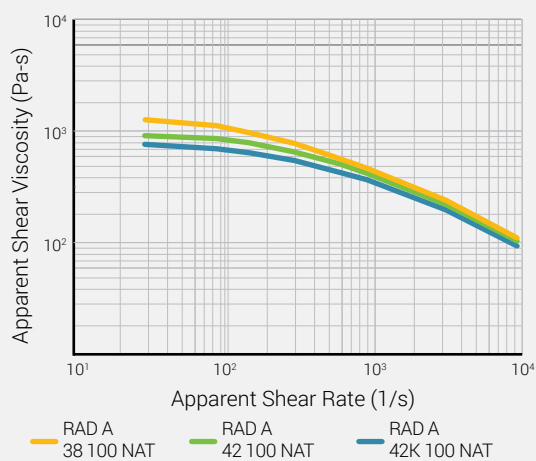
TEMPERATURE SETTINGS

PRODUCTS	ZONE 1	ZONE 2	ZONE 3	ZONE 4	ZONE 5	ADAPTER	DIE
S 32F	220-230	220-230	230-240	240-250	250-260	250-260	250-260
S 35L	220-230	240-250	250-260	250-260	250-260	250-260	250-260
S 35FL	220-230	240-250	250-260	250-260	250-260	250-260	250-260
S 40L	230-240	240-250	255-265	255-265	255-265	255-265	255-265
CA 27	255-260	260-265	260-265	260-265	260-265	265-270	265-270
CS 34FL	190-210	220-230	230-240	230-240	240-250	240-250	240-250
CS 38FL	190-210	220-230	230-240	230-240	240-250	240-250	240-250
CS T 38FL	220-230	230-240	240-250	250-260	250-260	250-260	250-260
CS 38 TX	220-230	230-240	240-250	250-260	250-260	250-260	250-260
A 42	260-270	265-270	270-280	275-285	275-285	275-285	275-285
A 42K	260-270	265-270	270-280	275-285	275-285	275-285	275-285
A 38	260-270	265-270	270-280	275-285	275-285	275-285	275-285
D 38	220-230	220-230	230-240	240-250	250-260	250-260	250-260
DT 38	220-230	220-230	230-240	240-250	250-260	250-260	250-260

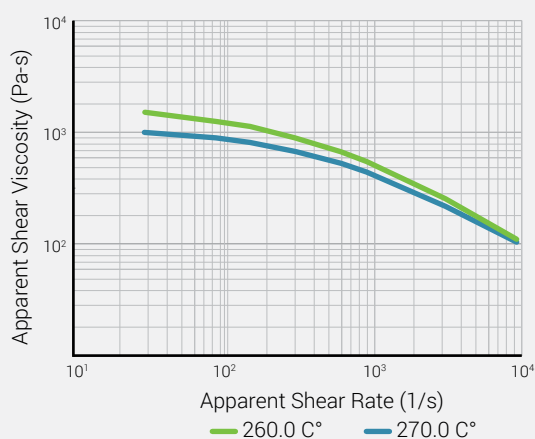
260°



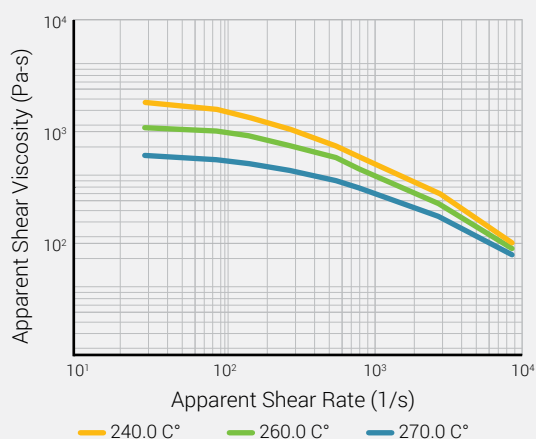
275°



RAD CS 38



RAD CS 34





HIGH PERFORMANCE
POLYMERS

Global Presence

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