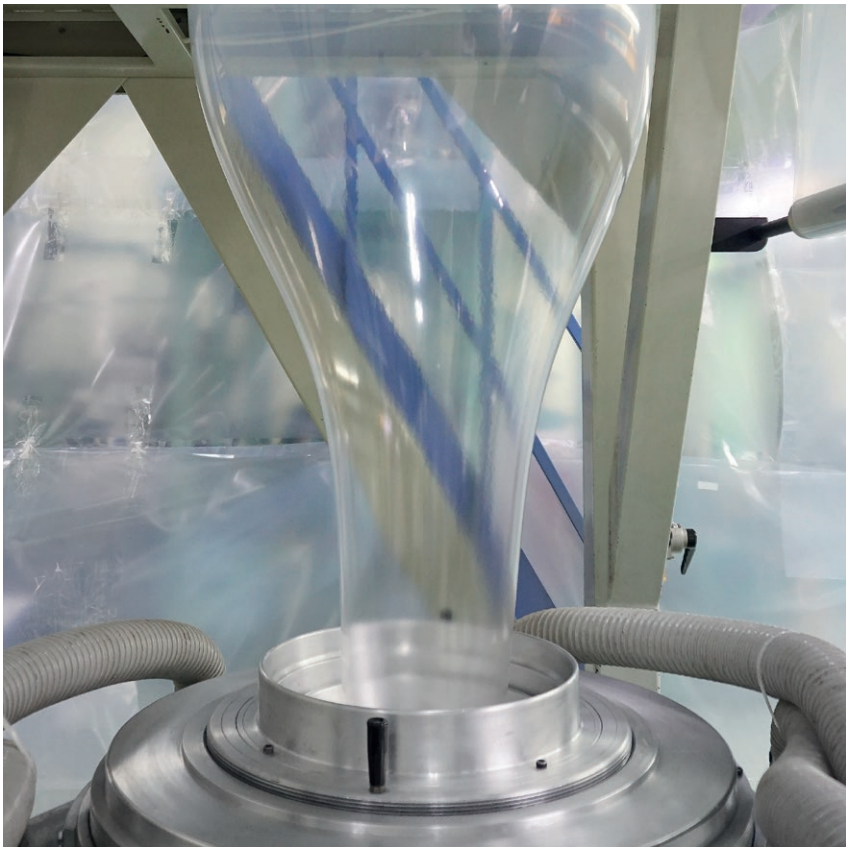


Let’s make a film of it

radipol®
cs

RADICI GROUP

Multi-possibilities with Co-polymers.

Radipol® cs co-polymers are based on **polyamide 6 and polyamide 66** process technologies, for plastics, extrusion of monofilaments, **extrusion and co-extrusion of films**. They are are specifically designed for **film manufacturing** with different processing technologies: oriented and non-oriented, monolayer and multilayer co-extruded films.

Radipol® cs film characteristics

Clear
with a lower haze %, for a high transparent functional optic.

Thermoformable
for deep-drawn packaging, saving costs.

Shrinkable
with flexibility to wrap any shape, creating a skin effect.

Heat resistant
to envelope hot products.

Chemically resistant
packaging that can safely contain chemical substances.

Gas barrier functional
to prevent the dispersion of dangerous agents and to increase the shelf life of products.

Mechanically resistant
to avoid breaking and perforations.

Puncture resistant
to pack even the most pointed items.

Barrier functional
thanks to a proper thickness distribution.

Food contact compliant
EU and FDA regulations.

Why choose Radipol® cs

- **Durability:** Radipol® cs grants different benefits to film: it optimizes packaging performance; it reduces polymer consumption by downgauging and it improves food protection by expanding shelf-life.
- **Green energy:** Radipol® cs production can count on 100% green energy, as it comes from green/renewable sources.
- **Recyclability:** Radipol® cs is recyclable. The property of PA layers in packaging is declared since September 1st, 2022 by 'Stiftung Zentrale Stelle Verpackungsregister' (Central Agency Packaging Register) in Germany.*

* Source: 'Minimum standard for determining the recyclability of packaging subject to system participation pursuant to section 21 (3) VerpackG', Annex 3.

radipol® cs

Quality and Safety. Especially in food contact

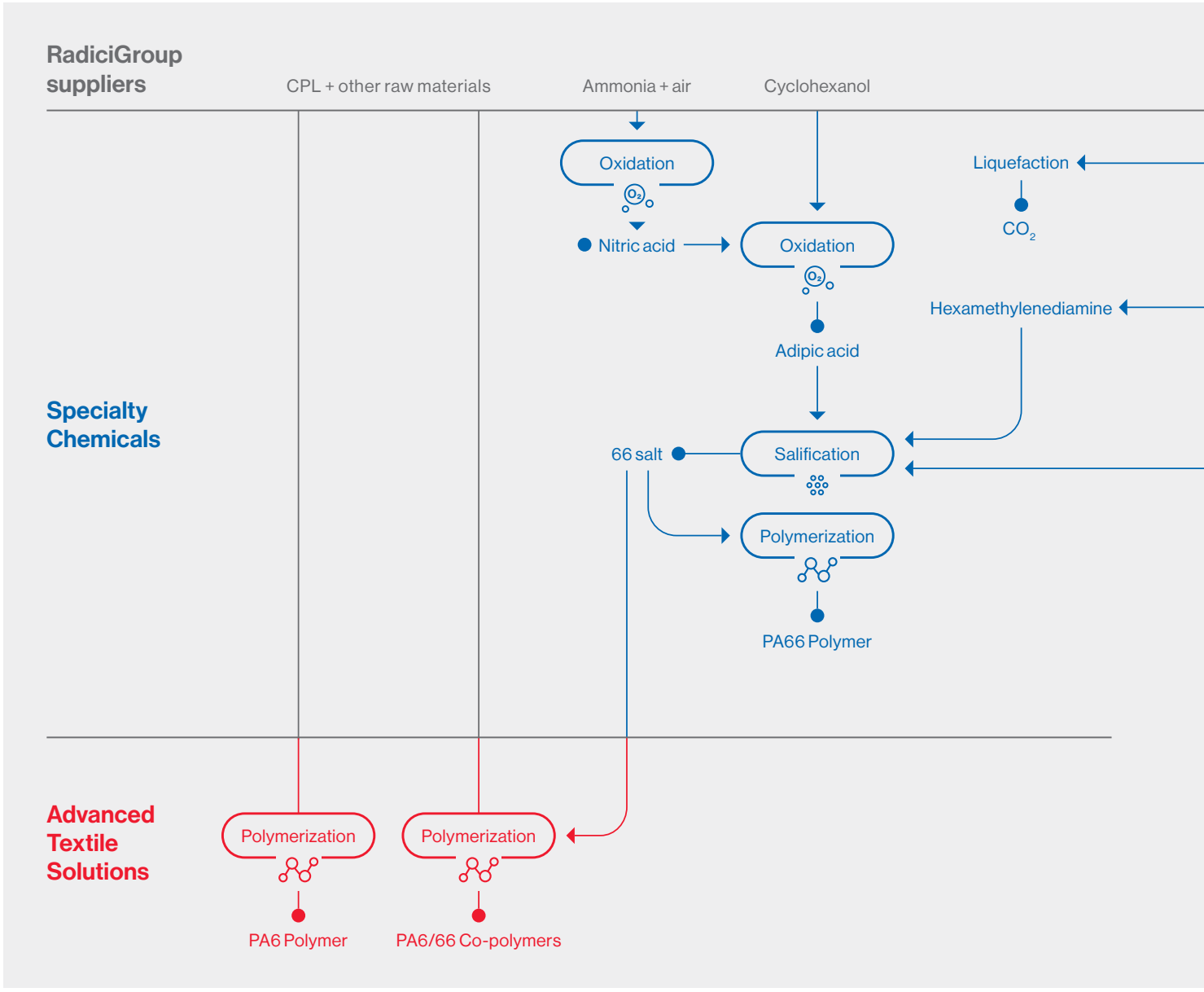
Radipol® cs film grades comply with **EU and FDA current legislation** on plastics materials:

EU
Commission Regulation (EU) n. 10/2011
Regulation (EC) 1935/2004
Regulation (EC) 2023/2006
USA FDA
21 CFR 177.1500 “Nylon Resins”, (a) 4 nylon 6/66 and (b) 4.1 and 4.2
21 CFR 177.1395 “Laminate structures”

The ideal solution to protect your food

Our solutions support you to increase your productivity, assuring **high performances** and **certified quality**.
Radipol® cs allows to extend the shelf-life of food and beverage. Moreover it satisfies packaging requirements and it helps to conserve the flavours and nutrients in foodstuffs.

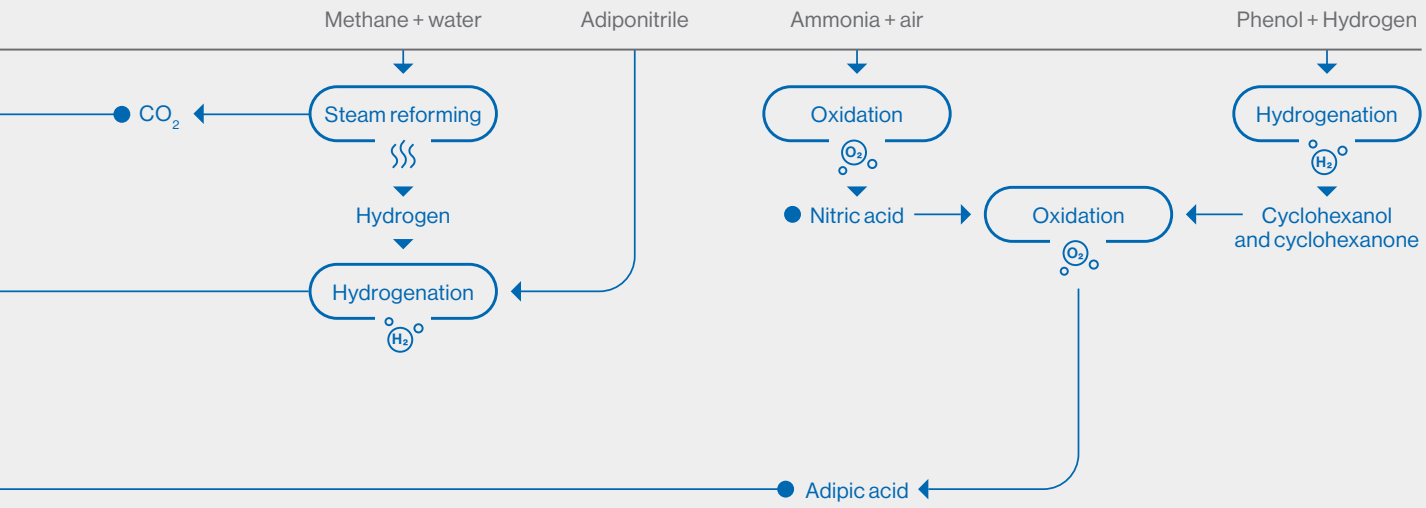
Your global partner for films



What makes us special

- **A global leader:**
  Radipol® is a product by RadiciGroup, one of the world's leading manufacturers of polyamides, synthetic fibres and engineering polymers.

- **Vertical integration:**
  Radipol® is the result of a vertically integrated PA66 and co-polymers production process, within RadiciGroup.



RadiciGroup is an example of **vertically integrated PA66 and co-polymers production**, starting with monomers, adipic acid, examethylenediamine, and the chemicals needed to obtain them. With technologically advanced systems for the production of adipic acid, production starts further upstream, not only with nitric acid but also with the raw materials needed, namely KA oil, a cyclohexanol /cyclohexanone mixture.

- **Polyamide performance:**
  Radipol® technological value and performance enhance the inherent properties of the packaging obtained.

- **Polyamide experience:**
  RadiciGroup provides strong capabilities and a longstanding experience in the world of polymers.

Radipol® cs endless possibilities

It gives even more choices to combine different polymers in multilayer films.
General prominent characteristics: modulus, curling, shrinkage, barrier functional, mechanical resistance, haze and thermoforming.

Food and beverage

Agriculture

Roofing and house wrapping

Food and beverage

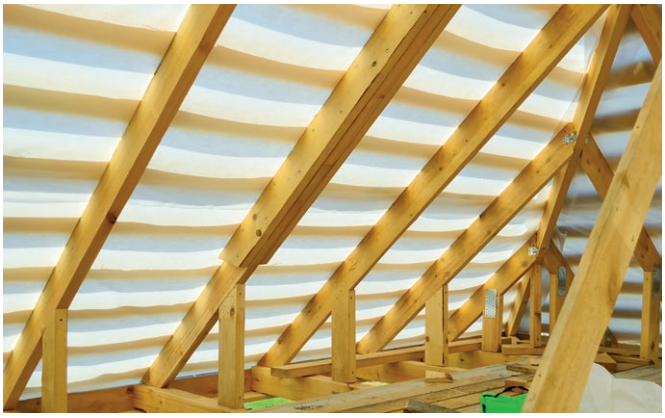
Thanks to its properties Radipol® cs is ideal to envelope **foods and beverages enhancing their shelf-life and contributing to decrease food waste**.

Agriculture

Thanks to its thermoforming properties and its mechanical resistance Radipol® cs grants high resistance and an easier handling that are ideal in **agriculture applications**.

Roofing and House wrapping

PA gives mechanics and high oil resistance (no discoloration of film), a 'must have' in films widely used for **roofing and house wrapping applications**.



Packaging and handling

Polyamide is a hygroscopic polymer that absorbs humidity after processing.
A polyamide film reaches its equilibrium by storing humidity in a controlled moisture and temperature environment.
Material is supplied pre-dried and ready to process. Bags and containers should be stored and kept closed in a dry place at room temperature for a time span not exceeding six-twelve months.

Packaging available
The multilayer packaging assures the correct storage of the co-polymer keeping unchanged its properties, like moisture and viscosity.

- **1,000 kg octabins** (PET/ALL/PA/PE)
- **25 kg bags** (PET/ALL/PA/PE) - placed on 1,000 kg pallet

System certifications

Voluntary management systems, implemented according to the most advanced and recognised international standards, make up a framework of best practices and valuable tools for sustainable management.
RadiciFil maintains a range of certifications covering a number of subjects from quality to safety, from environment to energy.

	ISO 9001:2015	ISO 14001:2015	ISO 45001:2018	ISO 50001:2018
RadiciFil SpA	✓	✓	✓	✓

Radipol® cs **film grade range**

RadiciGroup technologies allow to evaluate the integration of Radipol® cs range as for:

- Combination of co-monomers
- lubrication and/or nucleation

Radipol® cs grade	Polymer type
LX	PA6/66
TX	Semi aromatic PA6/66/IPD-IPA
FL	Semi aromatic PA6/IPD-IPA

Radipol® cs LX

is a co-polymer obtained by simultaneous polymerization of caprolactam and PA66 salt.

Radipol® cs LX grade	Viscosity	Treatments
CS34 LX	Medium	Neat resin
CS34 LXW	Medium	Lubricated
CS38 LX	High	Neat resin
CS38 LXNW	High	Nucleated and lubricated
CS40 LXW	High	Lubricated

Radipol® cs TX

is a semi aromatic ter-polymer (PA6/66/IPD-IPA) obtained by simultaneous polymerization of caprolactam, PA66 salt and a partially aromatic salt, giving special, enhanced, and innovative characteristics to the film.

Radipol® cs TX grade	Viscosity	Treatments
CS38 TX	High	Neat resin
CS38 TXNW	High	Nucleated and Lubricated
CS38 TXWA	High	Lubricated added amorphous nylon

Radipol® cs FL

is a semi aromatic co-polymer (PA6/IPD-IPA) obtained by simultaneous polymerization of caprolactam and a partially aromatic salt, giving special, enhanced, and innovative characteristics to the film.

Radipol® cs FL grade	Viscosity	Treatments
CS30FL	Medium	Neat resin
CS30FLW	Medium	Lubricated

Granule properties

Properties	Method	Unit	PA6 HVr*	CS38 LX	CS38 TX	CS30 FL
Relative viscosity	96% H_2SO_4 sulfuric acid	-	3,5	3,75	3,75	3,05
Melting point temperature	DSC 10°C/min	°C	220-222	195-197	198-200	210-212
Crystallization temperature	DSC 10°C/min	°C	175-180	135-145	140-150	150-160

Plastic specimen properties

Properties	Method	Unit	PA6 HVr*	CS38 LX	CS38 TX	CS30 FL
Stress at yield	ISO 527-2/1A (50 mm/min)	MPA	75	55	75	75
Nominal strain at break	ISO 527-2/1A (50 mm/min)	%	> 80	> 50	> 50	> 70
Flexural modulus	2 mm/min	-	2600	1750	2350	2400

* High relative viscosity.

Products development and quality control

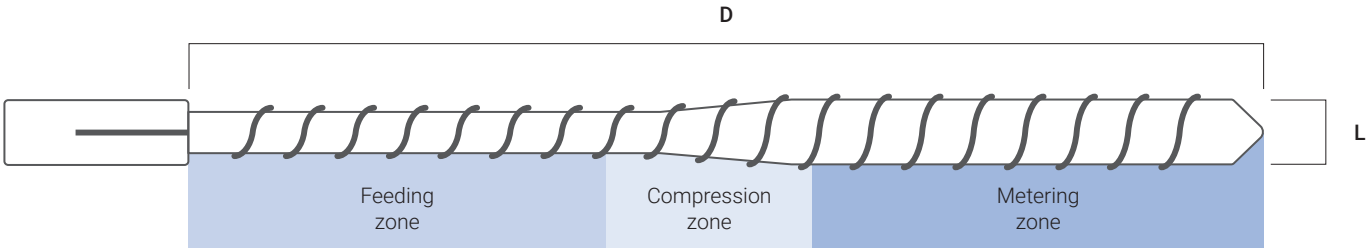
We have developed these Radipol® cs families to meet the **needs of our customers**.
Our R&D team uses its **know-how** to find the best possible solution considering both the final application, the available technology and the process. We work every day with our technical capacity to expand our range of products and guarantee **quality consistency**. Our laboratory are fully equipped to test and assure the quality of our products.

Processing recommendations

Extrusion

The screw design and different process temperatures ensure a homogenous melting of Radipol® cs and an ideal distribution of the additives.

Typical screw design for Radipol® cs



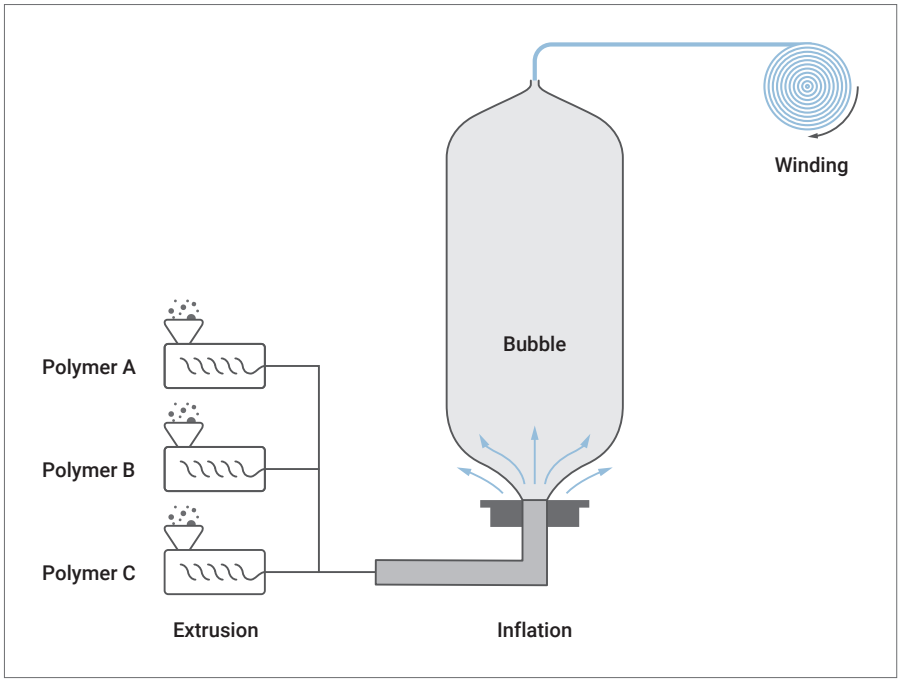
Compression ratio	Length			
		Feeding zone	Compression zone	Metering zone
3 < CR < 4	**L/D > 24**	8 to 12D	3 to 4D	8 to12D

Values depend on process technology.

Processing recommendations

From single bubble film extrusion

This continuous process allows to melt one or more polymers and to create a hollow cylinder, that is inflated and cooled with air, then collapsed and winded up, in sheets or tubulars.



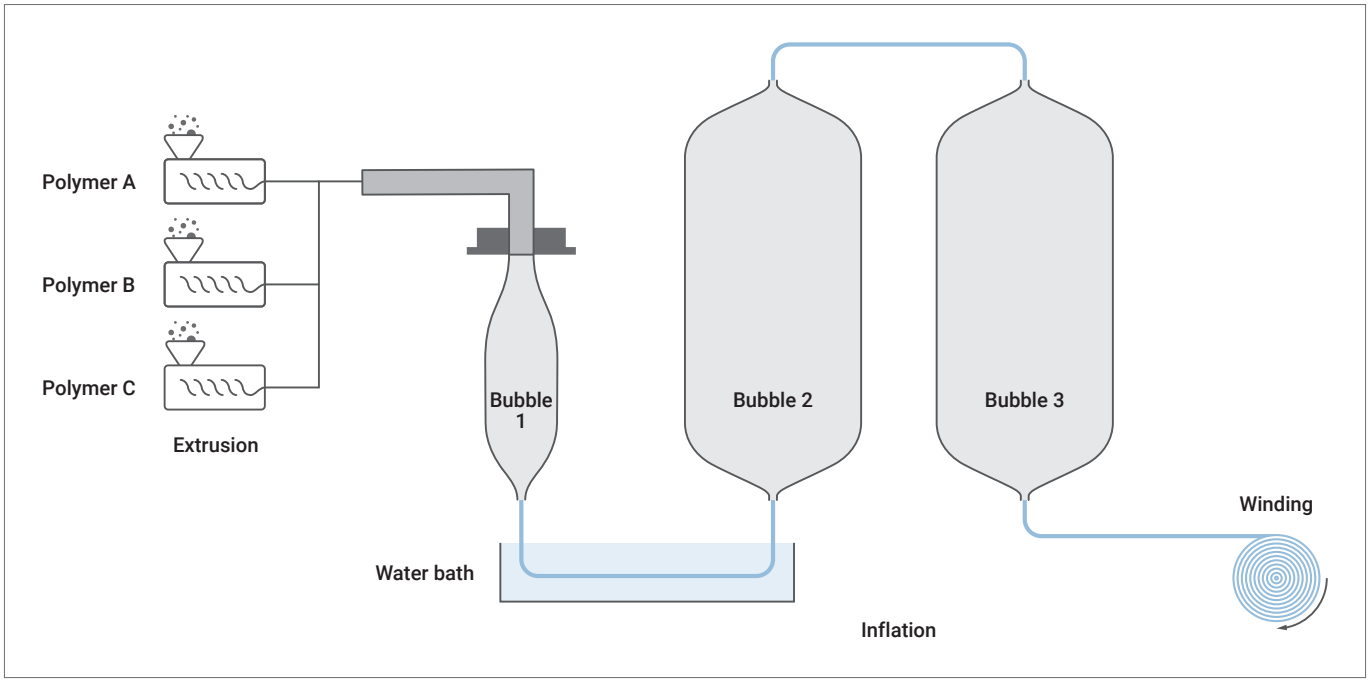
Typical processing conditions for Radipol® cs

Feeding temperature	Extruder temperature (°C)	
	PA6	Radipol® cs
Zone 1 (Hopper)	80-100*	80-100*
Zone 2	200-210	180-200
Zone 3	240-250	220-240
Zone 4	250-260	230-250
Zone 5	245-255	225-245
Adaptor	250-260	225-245
Dye	250-260	225-245

* Feeding temperature has to be adjusted according to extruder length and design.

To three bubbles film extrusion

This process is characterized by the use of water baths (cold and warm) on first collapsed bubble to reduce crystallization, then, to improve the shrinkage of the film, is inflated, oriented and treated in other two bubbles and, finally, winded up, in sheets or tubulars.



Film layer: some possible combinations

Non symmetric 3 layer blown film

	Layer	Thickness	Radipol® cs	
co-PA	outer	< 30 mic > 30 mic	CS38LXNW CS34LXW	CS38TXNW CS40LXW
x	tie			
PE				

Symmetric 5 layer blown film

	Layer	Thickness	Radipol® cs	
PE				
x	tie			
co-PA		< 30 mic > 30 mic	CS40LXW CS38LX	CS38TX CS38TX
x	tie			
PE				

Non symmetric

	Layer	Radipol® cs		
co-PA	outer	CS38LXNW		CS38TXNW
x	tie			
co-PA	embedded	CS38LX	CS38TX	CS40LXW
x	tie			
PE				

Symmetric

	Layer	Radipol® cs		
PE				
x	tie			
co-PA	embedded	CS38LX	CS38TX	CS40LXW
EVOH				
co-PA	embedded	CS38LX	CS38TX	CS40LXW
x	tie			
PE				

Non symmetric/symmetric

	Layer	Radipol® cs
PP		
x	tie	
co-PA	embedded	CS30FL
x	tie	
PP		

RadiciGroup.
Inside your world.

RadiciGroup is one of the world's leading producers of a wide range of chemical intermediates, polyamide polymers, high performance engineering polymers and advanced textile solutions, including nylon yarn, polyester yarn, yarn made from recovered and bio-source materials, nonwovens and personal protective equipment for the industrial and healthcare fields. These products are the result of the Group's outstanding chemical expertise and vertically integrated polyamide production chain and have been developed for use in a variety of industrial sectors, such as: automotive, electrical and electronics, household appliances, consumer and industrial goods, apparel, furnishing, construction, sports. The basis of the Group's strategy is a strong focus on innovation, quality, customer satisfaction and social and environmental sustainability.

Sustainability

Every day at RadiciGroup we work to make circularity our business model. We optimize the use of materials while fine-tuning our processes, eliminating waste, promoting recyclability from the earliest product design phases. We are always looking for low-impact solutions in terms of natural resources and energy. We rely on certified management systems for Safety, Environment and Energy to keep our companies in line with the highest sustainability standards.

1st Sustainability Report in 2004

GRI, third-party certified **Sustainability Report** covering all RadiciGroup companies worldwide.

>70% Emission reduction

Since 2011, in RadiciGroup plants, up to present.

Up to 60 times Water re-used

Water re-used in RadiciGroup production plants.

Data Source: RadiciGroup Sustainability Reports

RADICIFIL SPA
Via Europa, 41 - 24020 Casnigo (BG) - IT
Tel. +39 035 736000 - Fax +39 035 736350
www.radicigroup.com
flooring@radicigroup.com