

The logo for FKUR, featuring the letters 'FKUR' in a bold, white, sans-serif font. The 'K' and 'U' are stylized with horizontal bars through them. The logo is set against a background of blue plastic pellets on the left and a blue sky with green grass on the right.

FKUR

plastics - made by nature!®

Bio-Flex®
Design your own film!



Transparent Multilayer Film
made from Bio-Flex®



Multilayer Film
made from Bio-Flex®

Bio-Flex® – a family of renewable resins allowing you to design your own film

Plastics made by nature offer new opportunities and possibilities for both flexible and durable packaging applications. Each day nature displays well designed packaging solutions. These solutions can be used as a guideline and implemented in our industrial packaging world. Of course, we have different requirements for industrial packaging compared to nature. Most goods need to be transported, stored and protected against surrounding conditions and some need to withstand a long shelf life. Biopolymers, whether biodegradable or based on renewable resources, have a similar natural approach.

Biopolymers from the **Bio-Flex®** family create outstanding opportunities for your products. They provide you with the freedom to design a sustainable film for the applications that your customers require.

For over a decade the FKUR Group, together with its development partner Fraunhofer UMSICHT, has been developing and improving this resin family aimed at customer satisfaction and market demand. FKUR is constantly increasing its product range and have now designed a second generation of **Bio-Flex®** resins. Clarity, along with and a very high content of renewable resources, are now the key focus areas along with biodegradation and compostability.

Bio-Flex® resins generate added value and a sustainable solution for your applications!

Bio-Flex® resins have the following strengths and properties:

- 100% drop in solution and ready to use resins
- 100% replacement for several standard polymers
- Using combinations of **Bio-Flex®** resins makes it possible to adjust the required properties of the films
- Can be processed on standard LDPE lines without sacrificing throughput
- Have a wide processing window with melt temperatures in the range 165°C (329°F) to 190°C (374°F)
- Short purging and changeover times
- Recycling of **Bio-Flex®** films is possible and indeed recommended!
- Corona treatment for printing is not required - except when using water based inks
- Certified as compostable to EN 13432 and ASTM D 6400 (depending on blend)
- Food Approved to EC Directives and FDA (depending on blend)
- High content of renewable resource materials - up to 90% (depending on blend)

Bio-Flex® – resins supporting sustainable solutions

Bio-Flex® resins for mono and co-extruded films:

■ Bio-Flex® F 1110: Flexible and translucent

Within our product family, **Bio-Flex® F 1110** resin represents the highest elongation of all **Bio-Flex®** resins. Films made from this resin are translucent with a pleasant touch. Due to its mechanical properties **Bio-Flex® F 1110** is mainly used as a softening additive to increase the flexibility of other **Bio-Flex®** resins. Used as a mid-layer in a co-extrusion system it will modify the mechanical properties and adapt the flexibility of the whole structure. Used as an outer layer it works as a sealing layer generating a high sealing strength. **Bio-Flex® F 1110** is food contact approved and certified as compostable according to EN 13432.

■ Bio-Flex® F 1130: Standard resin for a wide range of applications

Known as the "easy to run" standard resin with good elongation properties and a low modulus. The closest 'standard' plastic comparable to **F 1130** is LDPE. **Bio-Flex® F 1130** has a pleasant soft touch and can be used in a wide range of applications such as mulch films, waste bags, hygienic films and shopping bags. It is available either as a natural or white coloured resin. In a multilayer film it supports the structure with its softness, pleasant touch and good sealing properties. **Bio-Flex® F 1130** is food contact approved and certified as compostable according to EN 13432 as well as ASTM D 6400.

■ Bio-Flex® F 2110: High value resin, tough and translucent

As a result of its gloss, feel and translucency, **Bio-Flex® F 2110** is our high value standard resin. If you want to compare it to a standard plastic, HDPE would be the closest. **Bio-Flex® F 2110** has excellent strength and is used for a variety of pouches and bags used with VFFS filling equipment. The main applications are loop handle shoppers, deep freeze pouches as well as numerous types of extruded and woven netting. **Bio-Flex® F 2110** is food contact approved and certified as compostable according to EN 13432 as well as ASTM D 6400.

■ Bio-Flex® F 2131: Resin suitable for waste bags

Of course **Bio-Flex® F 1130** fulfils many requirements and properties; however, for some applications some adjustments or different properties are required. **Bio-Flex® F 2131** has been designed for this purpose. It is a stiffer version of **Bio-Flex® F 1130** with nearly the same touch but with a tendency towards a "paper-like" feel. Both **F 2131** & **F 1130** can be dry blended together to adjust the mechanical properties. **Bio-Flex® F 2131** is certified as compostable according to EN 13432.

Bio-Flex® – the natural advantages are clear

Bio-Flex® resins for co-extruded films:

■ Bio-Flex® A 4100 CL: Provides high transparency and stiffness

If high transparency and stiffness are required then this resin is the right choice as its mechanical properties are comparable to OPP.

Bio-Flex® A 4100 CL has a high transparency and a renewable resource content of more than 90%. While the experienced manufacturer is in a position to produce **Bio-Flex® A 4100 CL** as a mono layer, integrating it into a multi-layer structure makes it a perfect partner for other **Bio-Flex®** resins. To maintain the clarity and to adjust different mechanical properties, **Bio-Flex® A 4100 CL** can be combined with all **Bio-Flex® F** resins without the use of a tie layer as the inter-ply strength is excellent.

Bio-Flex® A 4100 CL is food contact approved and certified as compostable according to EN 13432 as well as ASTM D 6400

■ Bio-Flex® F 2201 CL: Provides high transparency and flexibility

This brand new grade is transparent with a high content of renewable resources at approximately 60%. It is the perfect partner for **Bio-Flex® A 4100 CL** in a 3-layer combination. **Bio-Flex® F 2201 CL** has good elongation and flexibility along with good puncture resistance.

Therefore, it can be used to adjust the properties of all the available **Bio-Flex® F** family resins. It is recommended to use **Bio-Flex® F 2201 CL** as a mid-layer in a co-extruded structure. **Bio-Flex® F 2201 CL** is food contact approved.

■ Bio-Flex® S 1100: Provides a high barrier

The main advantage of the S-family is the improved temperature resistance and oxygen barrier when compared to **Bio-Flex® F** resins. In regard to its properties and surface touch, **Bio-Flex® S 1100** is similar to **Bio-Flex® F 2110**. It is mainly used as the mid-layer in combination with **Bio-Flex® A 4100 CL**. It maintains the clarity of the film but improves barrier and heat resistance properties.

Multilayer Structures of Bio-Flex® –

An intelligent combination of properties with added value

Market proven combinations and applications:



- Bio-Flex® A 4100 CL
- Bio-Flex® F 2110
- Bio-Flex® A 4100 CL

Clarity and a high content of renewable resources are achieved in this 3-layer structure. **Bio-Flex® F 2110** supports this structure with its toughness and **Bio-Flex® A 4100 CL** gives the transparency.

The most popular layer ratio is 20% / 60% / 20%. The main thickness range is 40 to 70µm (1,6 mil to 2,8 mil) with downgauging limited to approximately 25 microns (1 mil). The renewable content of this 3-layer structure is roughly 70%.

With such a structure the film can be used for VFFS applications. Pouches and deep freeze packaging, are some of the main applications.



- Bio-Flex® A 4100 CL
- Bio-Flex® F 2201 CL
- Bio-Flex® A 4100 CL

This combination offers a superb and unmatched clarity for a biodegradable blown film available today.

It has a very high content of renewable resources of between 60 - 80% (depending on the variation of polymers of the final structure). As both polymers are clear, the clarity of thin films for a 20µm (0,78 mil) film is close to 91%. The strength and high tear resistance result from **Bio-Flex® F 2201 CL** which is recommended to be used as a mid-layer.

The renewable content of a 20 micron 3-layer structure with a ratio of 20% / 60% / 20% is around 70%.

With such a structure, this film can be used in VFFS applications. Also, as a result of the breathability of this film, it can be used for all kinds of fresh fruit and vegetable packaging.



- Bio-Flex® A 4100 CL
- Bio-Flex® S 1100
- Bio-Flex® A 4100 CL

Due to the higher oxygen barrier properties and heat resistance when compared to other films in the **Bio-Flex® F** family, this structure offers interesting properties along with good contact transparency.



- Bio-Flex® F 1130
- Bio-Flex® F 2201 CL
- Bio-Flex® F 1130

By combining these two resins together, a very flexible film can be achieved, although some transparency is lost.

Bio-Flex® F 2201 CL supports **Bio-Flex® F 1130** with a high content of renewable resources and its toughness. A film ratio of 10% / 80% / 10% results in a renewable resource content of around 50%.

Note

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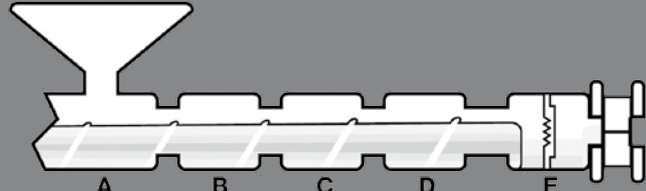
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Physical and mechanical properties

Multilayer Structures of Bio-Flex® – multilayer structure processing and design guide:

Product	Structure [%]	Thickness [µm]	Density [g/cm³]	Modulus of Elasticity [MPa]	Tensile strength		Tear Resistance		Elongation at Break [%]
					MD [MPa]	TD [MPa]	MD [N/mm]	TD [N/mm]	
Bio-Flex® resins for mono and co-extrusion films									
Bio-Flex® F 1110	100	20	1.28	230	27	15	364	246	> 500
Bio-Flex® F 1130	100	25	1.40	390	19	12	240	318	370
Bio-Flex® F 2110	100	22	1.27	730	30	21	215	218	495
Bio-Flex® F 2131	100	25	1.42	700	19	15	234	204	347
Bio-Flex® resins for co-extrusion films									
Bio-Flex® A 4100 CL	100	25	1.24	1840	47	40	94	120	17
Bio-Flex® F 2201 CL	100	30	1.24	760 (film)	29	30	121	111	> 150 (MD) (film)
Bio-Flex® S 1110	100	22	1.23	600	30	25	162	179	440
A choice of multi-layer structures films made from Bio-Flex®									
Bio-Flex® F 2110 / F 2201 CL / F 2110	20/60/20	25	1.25	740 / 685	35	28	107	130	240 / 215
Bio-Flex® A 4100 CL / F 2201 CL / A 4100 CL	20/60/20	20	1.24	910 / 725	35	26	170	125	240 / 250
Bio-Flex® A 4100 CL / S 1100 / A 4100 CL	40/20/40	30	1.24	1110 / 1220	25	36	205	107	130 / 190
Bio-Flex® F 1130 / F 2201 CL / F 1130	13/74/13	25	1.28	1040 / 1140	38	30	130	140	240 / 155

Processing Guide Extrusion

Product	Design	Structure [%]						Melt Pressure [bar]	Melt Temperature [C°]
			A [C°]	B [C°]	C [C°]	D [C°]	E [C°]		
A choice of multi-layer films made from Bio-Flex®									
Bio-Flex® F 2110 / F 2201 CL / F 2110	A	20	175	180	185	185	185	n.a.	n.a.
	B	60	160	170	175	180	180	50	n.a.
	A	20	175	180	185	185	185	45	n.a.
Bio-Flex® A 4100 CL / F 2201 CL / A 4100 CL	A	20	160	170	170	170	170	n.a.	n.a.
	B	60	150	160	170	170	170	n.a.	n.a.
	A	20	160	170	170	170	170	n.a.	n.a.
Bio-Flex® A 4100 CL / S 1100 / A 4100 CL	A	20	165	170	170	175	175	28	n.a.
	B	60	160	165	170	170	170	70	n.a.
	A	20	165	170	175	175	175	48	n.a.
Bio-Flex® F 1130 / F 2201 CL / F 1130	A	13	165	170	175	175	175	n.a.	n.a.
	B	74	160	170	175	180	180	60	n.a.
	A	13	165	170	175	175	175	75	n.a.

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