Ties that bind.

Connecting the diverse demands of multi-functional packaging.

Opposites attract. With a little help.

Tie-resins are taking packaging to new levels – and layers.

Packaging resins – as well as other packaging and industrial materials – can be finicky. They don't always get along. But adding a customized layer that helps them "connect" can open new possibilities in functionality, processability, and dependability.

BYNEL™ Adhesive Resins facilitate those connections. Functioning as a tie layer – specialty adhesives that bind dissimilar components together – BYNEL™ resins can bring together a variety of polar materials (EVOH, nylon, PET, etc.) and non-polar or low polarity polymers (e.g., polyethylene, polypropylene, polystyrene, etc.).

The bottom line? For practically anything needing to stick together, BYNEL™ resins offer maximum adhesion and processing performance, as well as other beneficial features for many applications.

A package deal.

BYNEL™ Adhesive Resins help take packaging performance to new levels. These high-quality, fully formulated tie layer resins offer excellent adhesion, minimize the potential for gels, simplify the conversion process, and maximize the reliability of the equipment and product performance.

Enabling strong bonds among diverse film types increases the possible number and types of structural layers, allowing the best-suited polymers to be used to improve functionality.

Another possible advantage is a better sustainability profile. By using high-performance tie layers, converters may be able to integrate new structural combinations using fewer resources.

Better packaging with more sustainability. That's a great deal!

Bynel™

adhesive resins by DOW

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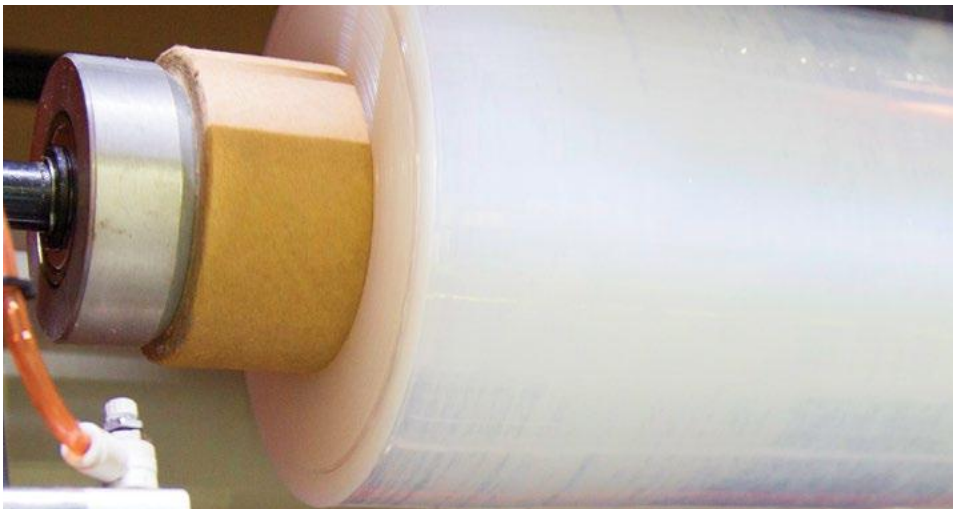
Making the connections.

The BYNEL™ Adhesive Resins portfolio offers options that provide exceptional adhesion among a wide range of polymers, including polyethylene (PE), nylon (PA), ethylene vinyl alcohol (EVOH), polypropylene (PP), polyethylene terephthalate (PET), polystyrene (PS), ethylene vinyl acetate (EVA), and other polymers commonly used in the packaging industry.

There are standard performance grades, most often used for blown film and extrusion blow molding processes, and high-performance grades most appropriate for extrusion coating or cast film processes which are more demanding for bond generation due to faster quenching.

Whatever the processing method, whatever the packaging substance, BYNEL™ tie-layers connect all the desires for high-quality structures: dependable and consistent adhesion, clarity, ease of processing, and overall package reliability.

The following pages offer guidance for bonding certain materials and appropriate processing methods for each.



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Bonding to EVOH

Tie layers made with BYNEL™ Adhesive Resins offer a variety of features and benefits when used to bond ethylene vinyl alcohol (EVOH) barrier film in packaging. These include:

Features

- offers uniform and consistent adhesion in thermoforming and flexure
- enables incorporation of oxygen barrier polymers in a structure
- delivers excellent processing

Benefits

- delivers dependable adhesion for challenging structures:
  - thermoformed pouches, trays, and complex film structures such as ones using ionomers
  - packaging with critical oxygen barrier performance, such as meat and cheese packaging
  - packages with aroma barrier polymers incorporated in the layers
  - high-abuse applications subjected to repeated flex stress
- offers easy processing for double- and triple-bubble processes

Table 1 presents suggested BYNEL™ adhesives and specifics for bonding EVOH to some common polymer substrates using various processing methods. Table 2 offers suggestions for bonding EVOH to more specialized materials.

Table 1: Bonding EVOH to LDPE, LLDPE, HDPE, EVA, or ionomers

To Bond EVOH To:	LDPE	LLDPE	HDPE	EVA	Ionomers
Standard Applications					
Blown Film, Sheet, Blow Molding	BYNEL™ 4104	BYNEL™ 4104	BYNEL™ 4104	BYNEL™ 4104	BYNEL™ 4104
Cast Film	BYNEL™ 4157	BYNEL™ 4157		BYNEL™ 4157	
High-Performance Applications					
Blown Film	BYNEL™ 41E687	BYNEL™ 41E687	BYNEL™ 41E687 BYNEL™ 40E529	BYNEL™ 41E687	BYNEL™ 41E687
Cast Film & Extrusion Coatings	BYNEL™ 42E703	BYNEL™ 42E703	BYNEL™ 42E703	BYNEL™ 42E703 BYNEL™ 38E802	BYNEL™ 42E703
Sheet & Blow Molding	BYNEL™ 4157	BYNEL™ 4157	BYNEL™ 4157 BYNEL™ 40E529	BYNEL™ 4157	BYNEL™ 4157
Specialty Applications					
Tubing, Pipe, and other Processes	BYNEL™ 4206 BYNEL™ 4208	BYNEL™ 4206 BYNEL™ 4208	BYNEL™ 40E529	BYNEL™ 4206 BYNEL™ 4208	BYNEL™ 4206 BYNEL™ 4208

Table 2: Bonding EVOH to PP, PS, PET

To Bond EVOH To:	Polypropylene	Polystyrene	PET
Standard Applications			
Blown Film	BYNEL™ 50E571	BYNEL™ 3861	BYNEL™ 21E787
High-Performance Applications			
Cast Films & Extrusion Coatings	BYNEL™ 50E739	BYNEL™ E418	BYNEL™ 21E533
Sheet	BYNEL™ 50E662	BYNEL™ 3810 BYNEL™ 41E3351B	BYNEL™ 21E810
Co-Injection Molding	BYNEL™ 50E803C		

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Bonding to nylon

Using BYNEL™ Adhesive Resins as tie layers enables bonding nylon-based film layers in packaging and can contribute to the advantages of a nylon-based substrate.

Features

- uniform and consistent adhesion through thermoforming and flexure
- high adhesion formulations available
- excellent processing

Benefits

- delivers dependable adhesion for challenging structures like deep-draw thermoformed trays
- provides high adhesion for applications such as barrier shrink bags
- can enhance puncture resistance of nylon-based films (grade dependent)
- contributes to higher or lower modulus in multi-layer structures (grade dependent)

Table 3 presents suggested BYNEL™ adhesives and their respective application methods for bonding nylon to common polymer substrates using various processing methods. Table 4 offers suggestions for more specialized materials.

Table 3: Bonding nylon to LDPE, LLDPE, HDPE, EVA, or ionomers

To Bond Nylon To:	LDPE	LLDPE	HDPE	EVA	Ionomers
Standard Applications					
Blown Film, Sheet, Blow Molding	BYNEL™ 4104	BYNEL™ 4104	BYNEL™ 4104	BYNEL™ 4104 BYNEL™ 30E671	BYNEL™ 4104
Cast Film	BYNEL™ 4157 BYNEL™ 4288	BYNEL™ 4157 BYNEL™ 4288	BYNEL™ 4157 BYNEL™ 4288	BYNEL™ 4288	BYNEL™ 4288
High-Performance Applications					
Blown Film	BYNEL™ 4157	BYNEL™ 4157	BYNEL™ 4157	BYNEL™ 4157 BYNEL™ 3930	BYNEL™ 4157 BYNEL™ 41E687
Cast Film & Extrusion Coatings	BYNEL™ 42E703	BYNEL™ 42E703	BYNEL™ 42E703	BYNEL™ 42E703	BYNEL™ 42E703
Sheet & Blow Molding	BYNEL™ 4157	BYNEL™ 4157	BYNEL™ 4157	BYNEL™ 4157	BYNEL™ 4157
Specialty Applications					
Tubing, Pipe, and other Processes	BYNEL™ 4206 BYNEL™ 4208	BYNEL™ 4206 BYNEL™ 4208	BYNEL™ 40E529	BYNEL™ 4206 BYNEL™ 4208	BYNEL™ 4206 BYNEL™ 4208

Table 4: Bonding nylon to PP, PS, or PET

To Bond Nylon To:	Polypropylene	Polystyrene	PET
Standard Applications			
Blown Film	BYNEL™ 21E810 BYNEL™ 3861	BYNEL™ 3861	BYNEL™ 21E781
High-Performance Applications			
Blown Film	BYNEL™ 50E571	BYNEL™ 38E802	BYNEL™ 21E787
Cast Films & Extrusion Coatings	BYNEL™ 50E739	BYNEL™ E418	BYNEL™ 21E533
Sheet	BYNEL™ 50E662	BYNEL™ 3810 BYNEL™ 41E3351B	BYNEL™ 21E810
Co-Injection Molding	BYNEL™ 50E803C		

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Bonding to other polyolefins

Polyolefins, e.g., the range of polyethylenes, polypropylenes, and elastomers, often require help in binding to each other, as well as other resin types. In a variety of specialty applications in packaging and industrial markets, select BYNEL™ resins are used as tie layers for adhesion to various polyolefins and specialty resins such as polyvinyl chloride (PVC) and thermoplastic polyurethanes (TPU). Table 5 lists some of these and the BYNEL™ resins best suited to each processing method. Consult with your Dow sales or technical representative about these and other options, such as ELVAX™ EVA, included in this table.

Table 5: Bonding polyolefins to PS, PET, PVC, and TPU[1]

To Bond Polyolefins To:	PS	PET	PVC	TPU
Standard Applications				
Blown Film	ELVAX™ EVA	BYNEL™ 22E780	BYNEL™ E418	BYNEL™ E418 BYNEL™ 21E533
Sheet & Blow Molding	ELVAX™ EVA	BYNEL™ 22E804	BYNEL™ E418	BYNEL™ E418 BYNEL™ 21E533
Cast Film	ELVAX™ EVA	BYNEL™ 22E757	BYNEL™ E418	BYNEL™ E418 BYNEL™ 21E533
High-Performance Applications				
Cast Film and Extrusion Coatings	BYNEL™ E418	BYNEL™ 21E533	BYNEL™ E418	BYNEL™ E418 BYNEL™ 21E533
Sheet	BYNEL™ E418	BYNEL™ 21E533	BYNEL™ E418	BYNEL™ E418 BYNEL™ 21E533

In-line blending. Outstanding performance.

Some grades of BYNEL™ Adhesive Resins can also be utilized as a graft concentrate for in-line tie-layer formulation. This is useful when the coextrusion equipment is designed to in-blend multiple feed streams during extrusion processing. The consistency of BYNEL™ resins, their low color, and ultra-low gels enable the production of high-quality films with the required adhesion to PE, nylon, EVOH, and various polymers.

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Connection. Commitment.

Table 6 details a portion of the portfolio of BYNEL™ Adhesive Resins for tie layers and their typical converting processes. It demonstrates some of the depth of options available. There are a variety of other grades to meet the broad spectrum of bonding needs. But there's more.

We have strong ties to the adhesives and packaging industries. And they're connected with the developmental opportunities available at our Pack Studios locations. Our energetic teams of adhesive and packaging professionals are committed to collaborating with you to deliver the tie layer and package performance your customers want and need.

Table 6: Partial portfolio of BYNEL™ Adhesive Resins

Product	Bonds To									Process	MFI @ 190C
	PE	PP	EVOH	Nylon	EVA	EMA	PS	PET	SURLYN™		
21E787	●		●	●	●	●		●	●	BF	1.6
4104	●			●	●	●				BF	1.1
4157	●		●	●	●	●			●	BF, CF	3.0
41E687	●		●	●	●	●			●	BF, DB, EBM, TE	1.7
41E710	●		●	●	●	●				All (Blending)	2.7
41E1352	●		●	●	●	●				BF, EBM	1.0
41E1451 / 41E1451B	●		●	●	●	●				BF, CF	1.8
41E3351B	●		●	●			●			SH	3.0
4288	●			●	●	●				CF, EC	4.7
42E703	●		●	●	●	●			●	CF, EC	6.0
50E571 50E662 50E739		●	●	●						BF SH CF, TE	3.5 (@230C) 4.0 (@230C) 6.0 (@230C)
50E803C		●	●	●						IM (Blending)	470
22E757 22E780 22E804	●	●			●	●		●	●	EC / BF / CF & SH	8.0 2.0 5.0
XUS 69B968*	●			●	●	●				BF, CF	2.4
XUS 69B969*	●		●	●	●	●				BF, CF	2.3

PE: Polyethylene, PP: Polypropylene, PS: Polystyrene, PVC: Polyvinylchloride, PET: Polyester, EC: Extrusion Coating, BF: Blown Film, CF: Cast Film, SH: Cast Sheet, TE: Tube/Pipe Extrusion, EBM: Extrusion Blow Molding, IM: Co-injection Molding

*Developmental product of The Dow Chemical Company [1]Typical values, not to be construed as specifications. Users should confirm results by their own tests.

Learn more about our entire portfolio of BYNEL™ Adhesive Resins. And for questions regarding unique applications, please contact your Dow sales or technical representative.

Together we make things better faster.

Four continents. Nine countries. Ten sites to date and a global virtual network of key players in the packaging value chain. In spaces tailor-made for imagining and creating new solutions, we collaborate to accelerate the innovations that help our customers succeed. Working together, with you, we can find ways for our diverse portfolio of packaging and adhesive resins – like BYNEL™ Adhesive Resins – to address your needs.

Let's connect and see what we can put together.

pack STUDIOS
COLLABORATE • INNOVATE • ACCELERATE

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