



## Dow Packaging & Specialty Plastics

### Product Data Sheet

#### BYNEL™ 41E1451B

#### Adhesive Resin

##### General Information

|                     |                                                                                                                                                                                                                                                                             |
|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Product Description | <p>BYNEL™ 4100 series resins are anhydride-modified, linear low-density polyethylene (LLDPE) resins.</p> <p>BYNEL™ 4100 series resins are available in pellet form for use in conventional extrusion and coextrusion equipment designed to process polyethylene resins.</p> |
|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

##### Status

|                 |                    |
|-----------------|--------------------|
| Material Status | Commercial: Active |
|-----------------|--------------------|

##### Typical Characteristics

|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Composition                | <p>Medium% By Weight Maleic Anhydride</p> <p>Graft levels are defined as:<br/>Low &lt; 0.2%; Medium 0.2-0.5%; High 0.5-1.0%; Ultra high &gt; 1.0%</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Characteristics / Benefits | Physical properties of BYNEL™ 4100 series resins are typical of linear low-density polyethylene resins with similar density and melt index values. Use of these adhesive resins in coextruded PE/barrier structures offers improved thermal resistance over that of ethylene vinyl acetate-based adhesive resins.                                                                                                                                                                                                                                                                                                                                                                                  |
| Applications               | <p>BYNEL™ 4100 series resins adhere to a variety of materials. They are most often used to adhere to EVOH, polyamide, PE and ethylene copolymers.</p> <p>BYNEL™ 4100 series resins can be used in coextrusion processes including:<br/>blown film<br/>cast film/sheet<br/>blow molding<br/>melt and solid phase thermoforming<br/>sheet and tubing</p> <p>LLDPE resins are known for their temperature resistance, clarity and toughness. These physical properties make the 4100 series resins work well in applications such as:<br/>boil-in-bag structures<br/>blow molded containers in which drop strength is important<br/>bag-in-box films<br/>film where LLDPE is the heat seal layer.</p> |

##### Typical Properties

| Physical                          | Nominal Values          | Test Method(s) |          |
|-----------------------------------|-------------------------|----------------|----------|
| *Density ( )                      | 0.906 g/cm <sup>3</sup> | ASTM D792      | ISO 1183 |
| *Melt Flow Index ( 190°C/2.16kg ) | 1.8 g/10 min            | ASTM D1238     | ISO 1133 |
| Thermal                           | Nominal Values          | Test Method(s) |          |
| *Melting Point( DSC )             | 122 °C ( 251.6 °F )     | Dow Method     |          |
| Vicat Softening Point ( )         | 86 °C ( 186.8 °F )      | ASTM D1525     | ISO 306  |

|                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|---------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Adhesive Evaluation | The performance of any adhesive resin should be evaluated within the context of the application. The adhesive is designed to bond materials that would not ordinarily adhere to each other. In most cases, peel strength is used as a measure of performance. Although this is a convenient test, peel strength is affected not only by adhesion, but also by peel angle, separation rate, temperature, and tensile and modulus properties of the materials, and often by the time elapsed since the formation of the bond. Post-treatment of the multi-layer structure, such as heat sealing, thermoforming or orientation can also affect peel strength. |
|---------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

If peel strength is used as a measure of adhesive performance, it is imperative that peel strength be evaluated not only at the time of manufacture, but throughout the life of the product and under all the various conditions to which the structure will be exposed. Only then can the performance of the adhesive be related to peel strength.

#### Processing Information

\*Maximum Processing Temperature 260 °C ( 500 °F )

#### General Processing Information

The temperature profiles shown below are for initial evaluations of BYNEL™ adhesive resins in the 4100 series. These profiles are designed to provide adequate exposure time of the adhesive resin to elevated temperatures. Exposure to elevated temperatures activates the anhydride which improves the bonding capability of the adhesive resin. Regardless of the profile used, the adhesive resin should be exposed to temperatures above 210C (410F) for several minutes prior to contact with the other molten resins in coextrusion in order to ensure adequate performance of the adhesive resin

In coextrusions with thermally sensitive resins such as EVOH or EVA, we suggest that the maximum melt temperature be limited to 235C (455F) to guard against overheating the EVOH or EVA. If adhesion results are adequate, we suggest evaluating even lower melt temperatures such as 210 - 220C (410 - 428F).

For coextrusion with polyamides or other thermally stable resins, the melt temperature can be higher. We suggest a maximum melt temperature of 260C (500F). This should provide acceptable bond strengths and film quality under almost all coextrusion conditions. If adhesion results are adequate, melt temperatures can be lowered. While it is possible to extrude BYNEL™ 4100 series resins as high as 300C (572F), such high extrusion temperatures, particularly when coupled with long residence times, may result in some film imperfections. In certain streamlined extrusion operations, where residence times are short, it may be possible to use temperatures higher than 260C (500F).

Variation of these suggested temperature profiles may be appropriate depending upon the screw configuration, potential extruder horsepower limitations, potential back pressure limitations, the need to match rheologies and/or the stability of the other resins in the coextrusion. Film quality will also depend upon the residence time of the adhesive resin in the system. Dead spots may result in localized overheating and should be avoided by ensuring the flow path for the adhesive is as streamlined as possible.

We suggest using any standard polyolefin working screw when extruding BYNEL™ 4100 series resins. Excessively deep flights should be avoided as they might result in poor melting of the adhesive resin. It is also important to properly size the extruder for the output desired. Running large extruders at very low RPMs should be avoided.

For producing monolayer adhesive films with BYNEL™ 4100 series adhesive resins, extrusion conditions commonly used for converting linear low density polyethylene into films can be employed.

If the coextrusion process is stopped for short periods of time, the screw in the adhesive extruder should be kept turning at a low RPM level. For a permanent shutdown, the BYNEL™ adhesive resin should be purged out using an available polyethylene resin run at the same extrusion temperature used during the extrusion process of the adhesive resin. Making frequent changes in screw speed during the shutdown process and subsequent start-up will help remove the previous material from the system more effectively. Sometimes upon start-up of the adhesive resin, excessive amounts of gel may be observed. This may be due to the natural ability of the adhesive resin to act as a purging compound. In this case, continued extrusion will eventually clear up the problem.

#### CoExtrusion w/ EVOH Processing Information

#### Nominal Values Proposed Extruder Set Temperatures

|             |                   |
|-------------|-------------------|
| Feed Zone   | 185 °C ( 365 °F ) |
| Second Zone | 210 °C ( 410 °F ) |
| Third Zone  | 235 °C ( 455 °F ) |
| Fourth Zone | 235 °C ( 455 °F ) |
| Fifth Zone  | 235 °C ( 455 °F ) |

|                        |                                    |
|------------------------|------------------------------------|
| Adapter Zone           | 235 °C ( 455 °F )                  |
| Die Zone               | 235 °C ( 455 °F )                  |
| CoExtrusion w/ Nylon   | Nominal Values                     |
| Processing Information | Proposed Extruder Set Temperatures |
| Feed Zone              | 185 °C ( 365 °F )                  |
| Second Zone            | 210 °C ( 410 °F )                  |
| Third Zone             | 235 °C ( 455 °F )                  |
| Fourth Zone            | 260 °C ( 500 °F )                  |
| Fifth Zone             | 260 °C ( 500 °F )                  |
| Adapter Zone           | 260 °C ( 500 °F )                  |
| Die Zone               | 260 °C ( 500 °F )                  |

**FDA Status Information**      **BYNEL™ 41E1451B Adhesive Resin** complies with Food and Drug Administration Regulation 21 CFR 175.105 - - Adhesives. This Regulation describes adhesives that may be used as components of articles intended for use in packaging, transporting, or holding food, subject to the limitations and requirements therein.

The information and certifications provided herein are based on data we believe to be reliable, to the best of our knowledge. The information and certifications apply only to the specific material designated herein as sold by Dow and do not apply to use in any process or in combination with any other material. They are provided at the request of and without charge to our customers. Accordingly, Dow cannot guarantee or warrant such certifications or information and assumes no liability for their use.

**Regulatory Information**      For information on regulatory compliance outside the U.S.A., consult your local Dow representative.

**Safety & Handling**      For information on appropriate Handling & Storage of this polymeric resin, please refer to the material Safety Data Sheet.

A Product Safety Bulletin, material Safety Data Sheet, and/or more detailed information on extrusion processing and/or compounding of this polymeric resin for specific applications are available from your Dow representative.

## Product Stewardship

Dow has a fundamental concern for all who make, distribute, and use its products, and for the environment in which we live. This concern is the basis for our product stewardship philosophy by which we assess the safety, health, and environmental information on our products and then take appropriate steps to protect employee and public health and our environment. The success of our product stewardship program rests with each and every individual involved with Dow products - from the initial concept and research, to manufacture, use, sale, disposal, and recycle of each product.

## Customer Notice

Dow strongly encourages its customers to review both their manufacturing processes and their applications of Dow products from the standpoint of human health and environmental quality to ensure that Dow products are not used in ways for which they are not intended or tested. Dow personnel are available to answer your questions and to provide reasonable technical support. Dow product literature, including safety data sheets, should be consulted prior to use of Dow products. Current safety data sheets are available from Dow.

## Medical Applications Policy

Any and all medical application use of Dow materials, whether a device, a component, or any type of primary or secondary packaging of a medically related object or substance, needs to be reviewed and approved by Dow before any Dow material can be tested in such application.

Dow requests that customers considering use of Dow products in medical applications notify Dow so that appropriate assessments may be conducted. Dow does not endorse or claim suitability of its products for specific medical applications. It is the responsibility of the medical device or pharmaceutical manufacturer to determine that the Dow product is safe, lawful, and technically suitable for the intended use. **DOW MAKES NO WARRANTIES, EXPRESS OR IMPLIED, CONCERNING THE SUITABILITY OF ANY DOW PRODUCT FOR USE IN MEDICAL APPLICATIONS.**

For further information contact your Dow sales or technical representative to request a Medical Application Review Request Form.

Additional details of Dow's Medical Applications Policy are available at:

<https://www.dow.com/en-us/support/product-safety.html>

## Tobacco and Marijuana Policy

Dow does not support or intend for its products to be used, directly or indirectly, in the production of tobacco, the manufacture of tobacco products, the manufacture and use of electronic cigarettes (including vaping devices), the production of marijuana, or the manufacture of marijuana products intended for human consumption, where the Dow product (or its residues) may be present in the finished product or be alleged to facilitate the delivery of nicotine, other tobacco components, marijuana, or marijuana components.

## Harmful Applications Policy

Dow does not intend for its products to be used in applications specifically intended to harm humans.

## Disclaimer

**NOTICE:** No freedom from infringement of any patent owned by Dow or others is to be inferred. Because use conditions and applicable laws may differ from one location to another and may change with time, the Customer is responsible for determining whether products and the information in this document are appropriate for the Customer's use and for ensuring that the Customer's workplace and disposal practices are in compliance with applicable laws and other governmental enactments. Dow assumes no obligation or liability for the information in this document. **NO WARRANTIES ARE GIVEN; ALL IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE ARE EXPRESSLY EXCLUDED.**

**NOTICE:** If products are described as "experimental" or "developmental": (1) product specifications may not be fully determined; (2) analysis of hazards and caution in handling and use are required; (3) there is greater potential for Dow to change specifications and/or discontinue production; and (4) although Dow may from time to time provide samples of such products, Dow is not obligated to supply or otherwise commercialize such products for any use or application whatsoever.

For additional information, not covered by the content of this document, contact us via our web site

[http://www.dow.com/products\\_services](http://www.dow.com/products_services)

**Revision Date: 26-February-2021**  
**P&SP Disclaimer**

**Additional Information**

To contact Dow via Toll-Free or Local Toll phone numbers in specific countries, please see the following webpage:  
<https://www.dow.com/en-us/support/contact-representative.html>

<http://www.dow.com>

**Updated February 2021**

**© 2019 The Dow Chemical Company**

Version: 76.0  
Last modified at 5/8/2020 7:17 PM