NORYL™ RESIN
CHEMICAL RESISTANCE PROPERTIES

THE NORYL™ FAMILY OF RESINS

The NORYL family of resins represents combinations of SABIC's innovative polyphenylene ether (PPE) technology blended with either high impact polystyrene (HIPS), polypropylene (PP), polyamide (PA) or thermoplastic elastomers (TPE), together with select additives and fillers.

These blends were created to add value by combining the strengths of both resins in order to address critical requirements such as chemical resistance, modulus, and processability.

PPE

As the building block for the NORYL family of resins, PPE provides a unique combination of properties that enhance its versatility.

PPE's characteristics include:

- Very low moisture uptake
- Excellent hydrolytic stability / hydrolysis resistance
- Long-term dimensional stability – even in high temperature, water, and humid conditions
- Mechanical property retention in a variety of environments, including ultra violet (UV) exposure
- Very low specific gravity
- Low warpage + low creep
- Excellent electrically insulative properties as a result of high dielectric strength
- Good impact, tensile strength and flexural strength
- Flame retardant grades are all non-brominated and non-chlorinated
- High heat resistance allows for cost-effective, high temperature performance

APPLICATION DEVELOPMENT CONSIDERATIONS

NORYL™ resin has been considered a material of choice for end-use applications in industries such as water management, healthcare and automotive interiors, where exposure to chemicals and cleaning agents is common. One of the most important application development and material selection considerations is the environment in which the end product will be used. This can include the effects of exposure not only to temperature extremes, but also to weather, UV rays, excessive moisture, solvents and chemicals.

THE EFFECTS OF CHEMICAL EXPOSURE

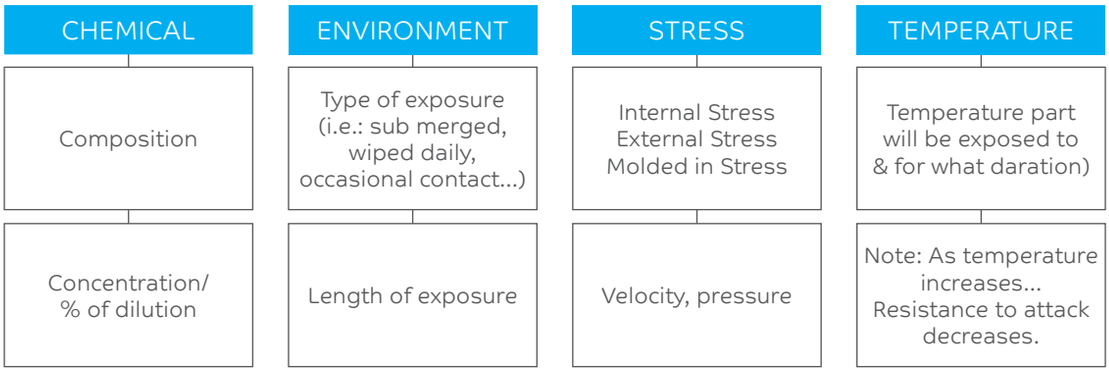
In many industries, end-use applications have the potential to be exposed to a myriad of chemicals and / or cleaning agents. This exposure may result in:

- Physical degradation – stress cracking, crazing, softening, swelling, discoloration
- Diminished performance – the reaction of the chemical with the polymer may result in the loss of mechanical or other performance properties of the thermoplastic

CHEMICAL RESISTANCE FACTORS

Chemical compatibility of thermoplastics is dependent on a number of criteria, including:

- Time
- Temperature
- Stress



Amorphous polymers tend to be highly viscous and more susceptible to chemical attack vs. crystalline and semi-crystalline polymers, which are typically low viscosity and easier-flowing materials.

Parts molded of crystalline resins will generally be lower stressed and more chemically resistant.

CHEMICAL RESISTANCE OF NORYL RESIN

The table below shows a chemical resistance comparison for three NORYL™ resin product families. Tensile behavior before and after immersion was tested. Within each product family, there may be individual compounds that behave differently, especially in end products that are subject to high internal stresses due to the processing technology used in their manufacture.

CHEMICAL	NORYL™ Resin PPE+HIPS (Amorphous)	NORYL GTX™ Resin PPE+PA (Semi-crystalline)	NORYL PPX™ Resin PPE+PP (Semi-crystalline)
Acids			
Inorganic	+	•	+
Organic	+	•	+
Oxidizing	+	•	+
Alcohols	+	+	+
Alkalis	+	+	+
Amines	–/•	–	+/•
Automotive fluids			
Greases (non-reactive organic esters)	•/+	+	+
Oils (unsaturated aliphatic mixtures)	•/+	+	+
Waxes (heavy oils)	•/+	+	+
Petrol	–	+	+
Cooling liquid (glycol)	+	+	+
Brake fluid (heavy alcohol)	+	+	+
Condensates & Condensate fumes	–	–	+
Detergents, Cleaners	•/+	++	+
Esters	+	+	+
Ethers	•	+	–/•
Free Chlorine	+	•	•
Hydrocarbons			
Aliphatic	•/–	+	+
Aromatic	–	+	+/•
Fully	-	+	+/•
Partly	–	•	+/•
Ketones	–	•	+/•
Phenols	–	•	+/•
UV *color shift (light colors)	•	–/•	–/•
UV *mechanical property retention	++	+	+
Water cold + hot, < 80°C	++	–	–/•

KEY		
++	Very good	Unaffected in its performance with regard to time, temperature and stress - According to agency requirements
+	Good	Acceptable in normal exposure - Long term exposure may result in minor loss of properties - Higher temperatures may result in major loss of properties
•	Fair	Marginal - Only for short exposures at lower temperatures or when - loss of mechanical properties is not critical
–	Poor	Unacceptable - Will result in failure or severe degradation
n	Not tested	

Note: The table is only indicative of relative differences in chemical resistance between various NORYL materials. Under no circumstances should this information be interpreted as representing finished and/or guaranteed part performance under actual or test conditions.

FOR MORE INFORMATION

Please contact your SABIC representative for additional information about NORYL resin products or visit **www.sabic.com**.

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