Delrin®
ONLY BY DUPONT

Making Hard-Soft Components That Work

Two-component injection molding technology allows you to produce one-piece molded parts combining DuPont™ Delrin® acetal resin with Ponaflex® thermoplastic elastomer (TPE).

Delrin® provides a stiff, strong structure with low wear and friction, dimensional stability and other desirable properties while Ponaflex® can provide a pleasingly soft touch and/or other functions such as gripping, sealing, cushioning, vibration dampening or noise abatement.

Hard-soft structures have a wide range of potential applications. They include conveyors, hand tools, gears and a host of other consumer and industrial products.

Adhesion improves part performance

Two-component injection molding is a process in which two molten materials are introduced into the mold cavity in a single shot. Since the two component materials are brought together in the melt state, it is often possible to achieve better adhesion between compatible materials than is obtained by overmolding or insert molding.

Adhesion between the two components of a hard-soft-part is often crucial to its functionality. Key influences on adhesion are the materials, the process, processing conditions, part design, surface quality and time.

For this automotive roof rack, Delrin® provides structural support, and Ponaflex® dampens impact and vibration forces.

- **Materials.** DuPont and Pongs & Zahn Plastics International have developed special grades of Delrin® and Ponaflex®, respectively, for two-component molding. All grades are tailored to maximize mutual adhesion. The special grades are:
  - Delrin® 542CM, a medium-viscosity acetal resin providing a balance of strength, stiffness, toughness and flow suitable for most applications.
  - Delrin® 142CM, a high-viscosity acetal resin providing increased toughness along with good strength and stiffness.
  - Ponaflex® S650A, a soft elastomer with Shore A hardness of 50.
  - Ponaflex® S680A, a firmer material with Shore A hardness of 80.
- **Process.** Two-component injection molding generally provides greater interface adhesion between Delrin® and Ponaflex® than insert molding.
- **Processing conditions**. See page 2 for recommended molding conditions for maximum adhesion and part quality.
- **Part design**. Important factors to consider are the area of common surface or interface and edge design.
- **Surface quality**. For maximum adhesion, the surface of the Delrin® part should be free of flow lines, gate smear, splays or any other surface defect. In case of problems, please refer to general processing guidelines for injection molding of Delrin®, available at plastics.dupont.com/delrin.
- **Time**. The bond between the two materials is weak immediately after part ejection, but it increases rapidly with time. Adhesion reaches a stable level after 24 h.

With good processing and design practice, adhesion between Delrin® CM grades and Ponaflex® is typically about 70% of the cohesive strength of the soft material.

DuPont has developed an extensive body of application technology that can help you achieve optimum results in your hard-soft components using Delrin® and Ponaflex®. Contact us today (see page 2 for contact information).

Material Properties: Delrin® Grades

Properties	Test Method ISO	Units	Delrin® 542CM	Delrin® 142CM
Yield stress	527-1/-2	MPa	72	71
Yield strain	527-1/-2	%	16	25
Strain at break	527-1/-2	%	40	65
Nominal strain at break	527-1/-2	%	30	45
Tensile modulus	527-1/-2	MPa	3100	2900
Flexural modulus	178	MPa	2900	2700
Izod impact, 23°C	180/1A	kJ/m^2	7	11
Charpy impact, notched at -30°C at 23°C	179/1eA	kJ/m^2	 8 8	 10 14
Deflection temperature at 1.8 MPa	75-1/-2	°C	95	95
Melt flow rate (resin) 190°C, 2.16 kg	1133	g/10 min	14	2.3
Specific gravity	1183	-	1.42	1.42

Ponaflex® Grades

Properties	Test Method ISO	Units	Ponaflex® S650A	Ponaflex® S680A
Hardness, Shore A	868	points	50	80
Tensile modulus	527-1/-2	MPa	32	123
Tensile stress at 50% strain at 100% strain at 300% strain	527-1/-2	MPa	 1.2 1.5 2.3	 2.8 3.1 4.4
Stress at break	527-1/-2	MPa	2.3	4.6
Strain at break	527-1/-2	%	355	374
Compression set, 70 h @ 23°C 24 h @ 70°C	815	%	 76 87	 97 104
Specific gravity	1183	-	1.02	1.08
Tg by DMA, 1 Hz	-	°C	-57	-68
Melt flow rate, 245°C	1133	g/10 min	44	16

Recommended Processing Conditions

Parameters	Units	Delrin® 542CM	Delrin® 142CM	Ponaflex® S650A	Ponaflex® S680A
Melt temperature	°C	215 ±5	215 ±5	245 ±5	245 ±5
Mold temperature	°C	80-100	80-100	70-80	70-80
Cooling time	s	As short as possible	As short as possible	As needed for part ejection	As needed for part ejection
Screw speed, tangential	m/s	0.3	0.2	0.4	0.4
Injection speed	s	1 s/mm of part thickness	1 s/mm of part thickness	Medium	Medium
Hold pressure	MPa	85	110	40	60
Back pressure	MPa	< 10	< 5	10-15	10-15
Hold pressure time	s	8-10 s/mm of part thickness	8-10 s/mm of part thickness	3-4 s/mm of part thickness	3-4 s/mm of part thickness
Pressure at switch point	MPa	80-90	80-90	30 to 50 % above hold pressure	30 to 50 % above hold pressure
Moisture content, max.	%	< 0.2	< 0.2	-	-
Drying conditions	h@°C	4@80	4@80	Not required	Not required

We've got solutions…

…and we're ready to help. Contact your nearest DuPont representative for assistance in part development or additional information. In the U.S.A., call 1-800-441-0575. In other countries, visit plastics.dupont.com for contact information in your region.

(800) 441-0575

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