



SOLVAY

asking more from chemistry®



High-Performance Polymers for
Automotive E/E Systems

**SPECIALTY
POLYMERS**



Get Connected with Solvay

Solvay offers the industry's broadest selection of high-performance plastics for automotive electrical/electronic (E/E) systems.

Amodel® PPA
Xydar® LCP

Veradel® PESU
Udel® PSU



Increased system complexity, higher operating and processing temperatures along with reduced weight allowances and overcrowded engines have made material selection a critical factor. Solvay's broad selection of high-performance plastics can help you meet these challenges.



	Semi-Crystalline Polymers		Sulfone Polymers	
	Amodel® PPA	Xydar® LCP	Udel® PSU	Veradel® PESU
Bobbins	√	√	√	√
Connectors	√	√		√
Engine control units	√			
Fuses	√		√	√
Housings	√		√	
LEDs	√	√		
Lighting sockets	√		√	√
Motor brush holders	√			
Motor end caps	√			
Relays	√			
Sensors	√	√	√	√
Solenoids	√			
Switches	√	√	√	

Dedicated Global Support

At Solvay, we place a high value on establishing close working relationships with our customers. We believe that the better we know you, the better we can serve you. That's why we have a global network of sales and technical support dedicated to the automotive industry. We understand the importance of reliable customer support and work hard to earn your confidence in us as your preferred materials supplier.

Semi-Crystalline Polymers

Amodel® PPA

Amodel® polyphthalamide (PPA) offers a broad product slate that gives you more ways to optimize performance, processing and price. These high-temperature polyamides are compatible with lead-free surface-mount technology (SMT) processing and are highly resistant to many commonly used electronic cleaning agents, fuels and automotive fluids.

Glass fiber reinforced grades offer exceptional weld line strength. Grades with high strength and high elongation are well-suited for snap-fit designs.

Key Features

- High strength and stiffness
- Withstands SMT processing up to 280 °C
- Low moisture absorption prevents blistering
- High flow for thin-wall designs and precision overmolding
- Continuous use from 120 °C–185 °C for 5,000 hours
- Excellent electrical insulating properties
- Excellent dimensional stability
- High strength and stiffness for good pin retention
- Good adhesion to silicone and epoxy
- Fast cycle times for lower molding costs
- Meets established OEM specifications

Xydar® LCP

Xydar® liquid crystal polymer (LCP) is a highly crystalline, glass-filled resin that offers exceptional flow properties. It can be injection molded into very thin-walled components having long flow lengths, with little or no flash.

This material can withstand SMT assembly, including lead-free solder reflow, and retains its high strength and stiffness up to 300 °C. It is inherently flame retardant and resistant to virtually all chemicals.

Key Features

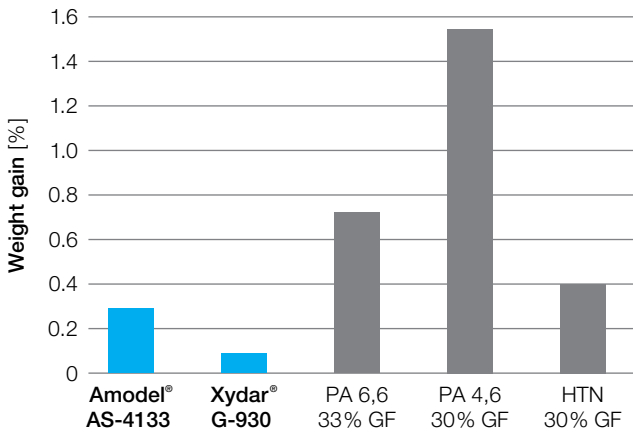
- Withstands SMT processing up to 280 °C
- High strength and stiffness up to 300 °C
- Very high flow to fill long, thin-walled components
- Mold complex geometries with tight tolerances
- Outstanding chemical resistance
- Inherently flame retardant



Lower Moisture Prevents Blistering

Blistering is primarily caused by water vaporizing during SMT processing. Amodel® PPA absorbs significantly less moisture than conventional nylons and other high-temperature nylons, making it an excellent candidate for SMT processing up to 280°C.

Water absorption



Better Mechanical Properties and Faster Cycle Times

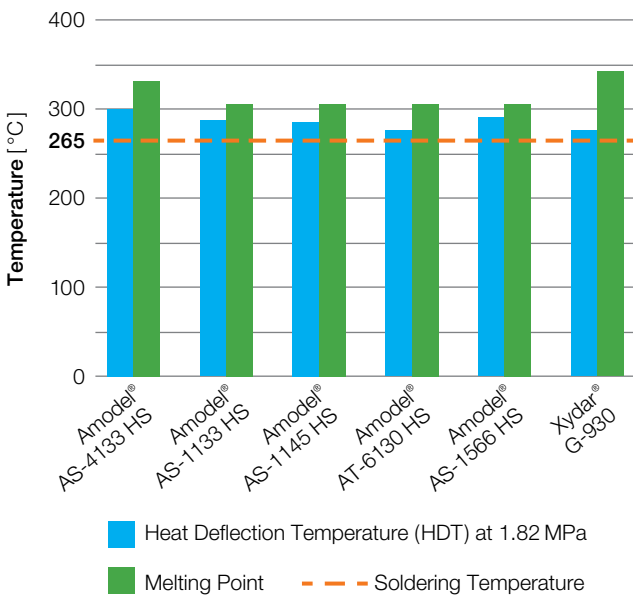
Materials like PPS may pass solder dip tests, but lack the tensile and flexural properties required for many electronics applications. Amodel® PPA delivers strength, toughness and impact resistance along with low moisture absorption, high HDT and faster injection molding cycle times.

One-minute solder dip test

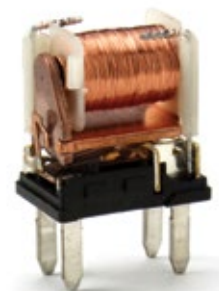
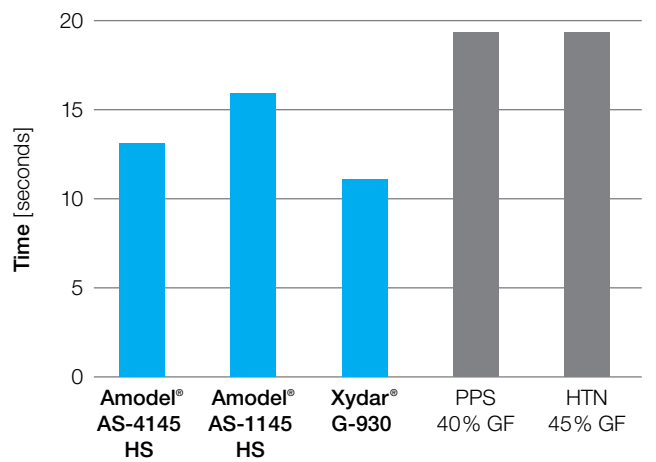
	250°C	260°C	270°C	280°C
Amodel® PPA	OK	OK	OK	OK
Xydar® LCP	OK	OK	OK	OK
PA 4,6	OK	Blisters	Blisters	Blisters
HTN	OK	OK	Blisters	Blisters
PCT	OK	Blisters	Blisters	Blisters
PPS	OK	OK	OK	Softens

Test bars conditioned at 23°C in 50% relative humidity for 48 hours.

Reliable high-temperature performance



Injection molding cycle times



Semi-Crystalline Grades for Automotive E/E Systems

Amodel® PPA

High Strength	
AS-1133 HS	High strength, 33% glass fiber
AS-1145 HS	High strength, 45% glass fiber
AS-1566 HS	Low cost, low warpage, 66% mineral/glass
A-4160 HSL	High stiffness, 60% glass fiber, water-cooled molding
AS-4133 HS	High strength, 33% glass fiber, water-cooled molding
AS-4145 HS	High strength, 45% glass fiber, water-cooled molding
Toughened	
AT-1002 HS	High elongation, toughened, unfilled, water-cooled molding
ET-1000 HS	Impact modified, unfilled, water-cooled molding
AT-1116 HS	Toughened, 16% glass fiber
AT-6115 HS	Toughened, 15% glass fiber, water-cooled molding
AT-6130 HS	Toughened, 30% glass fiber, water-cooled molding
Conductive	
A-1625 HS	Conductive for electrostatic dissipation

High Flow	
A-6135 HN	High flow, not lubricated, water-cooled molding
HFZ A-4133 L	High flow, water-cooled molding
Electrical	
AE-4133	Eliminates corrosion issues in high-temperature and high-humidity conditions, 33% glass fibers
Flame Retardant	
AFA-6133 V0 Z	Flame retardant, 33% glass fiber, water-cooled molding
HFFR-4133	Halogen-free flame retardant, 33% glass fiber, water-cooled molding

Xydar® LCP

HighFlow Glass Filled	
G-930	30% glass fiber



Semi-Crystalline Polymers Typical Properties

Property ⁽¹⁾	Units	Amodel®	Amodel®	Amodel®	Amodel®	Amodel®	Amodel®	Test Method
		AS-1133 HS	AS-1145 HS	AS-1566 HS	A-4160 HSL	AS-4133 HS	AS-4145 HS	
Tensile strength	MPa	225	263	200	244	211	224	ISO 527
	kpsi	32.6	38.1	29.0	35.0	30.6	32.5	
Tensile modulus	GPa	12.2	16.0	22.8	23.3	12.6	16.1	ISO 527
	kpsi	1,770	2,320	3,260	3,330	1,830	2,340	
Tensile elongation	%	3.0	2.7	1.4	1.4	2.6	2.2	ISO 527
Flexural strength	MPa	326	376	284	385	296	327	ISO 178
	kpsi	47.3	54.5	41.2	55.8	42.9	47.4	
Flexural modulus	GPa	10.3	14.8	20.8	19.3	10.4	13.4	ISO 178
	kpsi	1,490	2,150	2,980	2,800	1,510	1,940	
Izod impact strength, notched	kJ/m ²	10.5		6.6		9.7	10.0	ISO 180/1A
	ft-lb/in ²	5.0		3.1		4.6	4.8	
Izod impact strength, unnotched	kJ/m ²	82	14	44		59		ISO 180/1U
	ft-lb/in ²	39	6.7	21		28		
Heat deflection temp, 1.82 MPa (264 psi)	°C	277	279	280	304	294	298	ISO 75AF
	°F	531	534	536	579	561	568	
Melting point	°C	310	312	311	327	327	320	ISO 11357-3
	°F	590	594	592	621	620	608	
CLTE, flow direction, 0°C–100°C	ppm/°C	24	15	17		22	16	ASTM E831
	ppm/°F	13	8	9		12	9	
CLTE, transverse direction, 0°C–100°C	ppm/°C	60	50	44		59	59	ASTM E831
	ppm/°F	33	28	24		33	33	
Flammability, 0.8 mm bar		HB	HB	HB	HB	HB	HB	UL 94
Hot wire ignition, 0.8 mm bar	PLC ⁽²⁾	0				0 ⁽³⁾		UL 746A
Comparative tracking index	PLC	0	0	0		0	0	UL 746A
Glow wire ignitability temp, 0.8 mm bar	°C	725	960	775		750		IEC 695-2-1/3
	°F	1,337	1,760	1,427		1,382		
Specific gravity		1.44	1.56	1.84	1.75	1.45	1.55	ISO 1183A
Water absorption, 24 hours	%	0.2	0.1	0.1	0.2	0.3	0.2	ISO 62
Mold shrinkage, flow direction	%	0.4	0.2	0.3	0.5	0.5	0.5	ISO 294-4
Mold shrinkage, transverse direction	%	0.8	0.6	0.5	0.8	1.0	0.8	ISO 294-4

⁽¹⁾ Actual properties of individual batches will vary within specification limits.

⁽²⁾ PLC=Performance Level Category. Best performance assigned to category 0.

⁽³⁾ Measured using a 1.5 mm bar.

Semi-Crystalline Polymers Typical Properties, continued

Property ⁽¹⁾	Units	Amodel® AT-1002 HS	Amodel® ET-1000 HS	Amodel® AT-1116 HS	Amodel® AT-6115 HS	Amodel® AT-6130 HS	Amodel® AE-4133	Test Method
Tensile strength	MPa	75	70	160	114	170	210	ISO 527
	kpsi	10.9	10.2	23.2	16.5	24.6	30.5	
Tensile modulus	GPa	2.3	1.8	6.7	4.3	7.6	10.7	ISO 527
	kpsi	4,000	3,500	1,000	780	1,350	1,740	
Tensile elongation	%	15	7.0	3.7	3.9	3.3	2.5	ISO 527
Flexural strength	MPa	2.8	2.4	6.9	5.4	9.3	12.0	ISO 178
	kpsi	11.5	10.2	28.6	24.7	32.6	42.8	
Flexural modulus	GPa	80	70	197	170	225	295	ISO 178
	kpsi	3,300	2,600	970	620	1,100	1,550	
Izod impact strength, notched	kJ/m ²	13	74	8.1	11.6	13.2	9.2	ISO 180/1A
	ft-lb/in ²	6.0	35	3.8	5.5	6.3	4.4	
Izod impact strength, unnotched	kJ/m ²	No break	No break	53	54	62	68	ISO 180/1U
	ft-lb/in ²	No break	No break	25.0	26.0	29.2	32.0	
Heat deflection temp, 1.82 MPa (264 psi)	°C	118	109	258	265	276	>300	ISO 75AF
	°F	244	228	497	509	529	>572	
Melting point	°C	315	310	310	307	306	327	ISO 11357-3
	°F	599	590	590	585	583	621	
CLTE, flow direction, 0 °C – 100 °C	ppm/°C	85	85	23	21		20	ASTM E831
	ppm/°F	47	47	13	12		11	
CLTE, transverse direction, 0 °C – 100 °C	ppm/°C	101	81	77	97		76	ASTM E831
	ppm/°F	56	45	43	54		42	
Flammability, 0.8 mm bar		HB	HB	HB	HB	HB	HB	UL 94
Hot Wire Ignition, 0.8 mm bar	PLC ⁽²⁾				0 ⁽³⁾	0		UL 746A
Comparative tracking index	PLC	0			0			UL 746A
Glow wire ignitability temp, 0.8 mm bar	°C				750			IEC 695-2-1/3
	°F				1,382			
Specific gravity		1.13	1.13	1.28	1.22	1.34	1.45	ISO 1183A
Water absorption, 24 hours	%	0.5	0.7	0.2	0.2	0.2	0.2	ISO 62
Mold shrinkage, flow direction	%	2.0	1.5	0.6	1.0	0.5	0.4	ISO 294-4
Mold shrinkage, transverse direction	%	2.1	1.5	0.6	1.1	0.8	0.8	ISO 294-4

⁽¹⁾ Actual properties of individual batches will vary within specification limits.

⁽²⁾ PLC=Performance Level Category. Best performance assigned to category 0.

⁽³⁾ Measured using a 1.5 mm bar.

Semi-Crystalline Polymers Typical Properties, continued

Property ⁽¹⁾	Units	Amodel® A-1625 HS	Amodel® A-6135 NL	Amodel® HFZ A-4133 L	Amodel® AFA-6133 V0 Z	Amodel® HFFR-4133	Xydar® G-930	Test Method
Tensile strength	MPa	180	211	180	186	160	135	ISO 527
	kpsi	26.0	30.6	26.1	27.0	23.2	19.6	
Tensile modulus	GPa	13.1	11.5	12.0	14.5	12.0	15.8	ISO 527
	kpsi	1,890	1,670	1,740	2,100	1,740	2,290	
Tensile elongation	%	2.0	2.0	1.8	1.6	2.3	1.6	ISO 527
Flexural strength	MPa	275	300	255	259	230	283	ISO 178
	kpsi	39.9	43.5	37.0	37.6	33.4	41.1	
Flexural modulus	GPa	10.9	11.4	11.0	12.6	10.8	16.7	ISO 178
	kpsi	1,580	1,650	1,600	1,830	1,570	2,430	
Izod impact strength, notched	kJ/m ²	9.3	9.1	8.4	8.0	7.9	10.5	ISO 180/1A
	ft-lb/in ²	4.4	4.3	4.0	3.9	3.8	5.0	
Izod impact strength, unnotched	kJ/m ²	50	62	40	44	48	18	ISO 180/1U
	ft-lb/in ²	24	30	19	21	23	8.5	
Heat deflection temp, 1.82 MPa (264 psi)	°C	275	288	310	277	300	271	ISO 75AF
	°F	527	550	590	531	572	520	
Melting point	°C	319	310	327	310	327	330	ISO 11357-3
	°F	606	590	621	590	621	626	
CLTE, flow direction, 0°C–100°C	ppm/°C	9 ⁽⁴⁾	23	20 ⁽⁵⁾	16	20	3–7	ASTM E831
	ppm/°F	5 ⁽⁴⁾	13	11 ⁽⁵⁾	9	11	2–4	
CLTE, transverse direction, 0°C–100°C	ppm/°C	47 ⁽⁴⁾	63	64 ⁽⁵⁾	72	80	40–80	ASTM E831
	ppm/°F	26 ⁽⁴⁾	35	35 ⁽⁵⁾	40	44	22–44	
Flammability, 0.8 mm bar		HB	HB	HB	V-0	V-0	V-0	UL 94
Hot Wire Ignition, 0.8 mm bar	PLC ⁽²⁾			1	0			UL 746A
Comparative tracking index	PLC				1		3	UL 746A
Glow wire ignitability temp, 0.8 mm bar	°C			800	960			IEC 695-2-1/3
	°F			1,472	1,760			
Specific gravity		1.26	1.45	1.46	1.68	1.46	1.60	ISO 1183A
Water absorption, 24 hours	%	0.3	0.3	0.3	0.2	0.3	<0.1	ISO 62
Mold shrinkage, flow direction	%	0.4	0.5	0.5	0.3	0.3	0.01	ISO 294-4
Mold shrinkage, transverse direction	%	0.6	1.0	1.0	0.6	1.3	0.4	ISO 294-4

⁽¹⁾ Actual properties of individual batches will vary within specification limits.

⁽²⁾ PLC=Performance Level Category. Best performance assigned to category 0.

⁽³⁾ Measured using a 1.5 mm bar.

⁽⁴⁾ Coefficient of Linear Thermal Expansion reported as average for flow from 0°C–50°C.

⁽⁵⁾ Coefficient of Linear Thermal Expansion reported as average for flow from 0°C–90°C.

Sulfone Polymers

Sulfone polymers are amorphous high-heat polymers that retain their mechanical strength in some of the toughest environments. Unfilled grades offer good ductility and are available in a range of transparent colors.

Udel® polysulfone (PSU) has an HDT of 174 °C and provides excellent dimensional and hydrolytic stability. Veradel® polyethersulfone (PESU) has an HDT of 204 °C and offers better chemical resistance than Udel® PSU resins.

Key Features

- High glass transition temperatures up to 220 °C
- Strength and toughness at elevated temperatures
- Excellent hydrolytic stability
- Good electrical insulation properties
- High elongation for good ductility
- Warp resistance

Udel® PSU grades

P-1700 NT	Transparent, high ductility
GF-120	20 % glass fiber
GF-130	30 % glass fiber, UL 94 V-0, high stiffness

Additional grades are available.

Veradel® PESU grades

AG-320	20 % glass fiber, high T _g
AG-330	30 % glass fiber, high T _g , high stiffness

Additional grades are available.



Sulfone Polymers Typical Properties

Property ⁽¹⁾	Units	Udel® P-1700 NT	Udel® GF-120	Udel® GF-130	Veradel® AG-320	Veradel® AG-330	Test Method
Tensile strength	MPa	70	97	108	109	130	ASTM D638
	kpsi	10.2	14.0	15.6	15.8	18.9	
Tensile modulus	GPa	2.5	6.0	8.7	5.7	8.6	ASTM D638
	kpsi	360	870	1,260	830	1,250	
Tensile elongation	%	50–100	3.0	2.0	3.2	1.9	ASTM D638
Flexural strength	MPa	106	148	154	162	180	ASTM D790
	kpsi	15.4	21.5	22.4	23.5	26.0	
Flexural modulus	GPa	2.7	5.5	7.6	6.6	8.6	ASTM D790
	kpsi	390	800	1,100	950	1,250	
Izod impact strength, notched	kJ/m ²	69	53	69	59	75	ASTM D256
	ft-lb/in ²	1.3	1.0	1.3	1.1	1.4	
Izod impact strength, unnotched	kJ/m ²	No break	477	430	640	530	ASTM D256
	ft-lb/in ²	No break	9	8	12	10	
Heat deflection temp, 1.82 MPa (264 psi)	°C	174	180	181	214	216	ASTM D648
	°F	345	356	358	417	420	
Glass transition temperature	°C	190	190	190	220	220	DSC
	°F	374	374	374	428	428	
CLTE, flow direction, 0 °C – 100 °C	ppm/°C	56	23	19	31	31	ASTM E831
	ppm/°F	31	13	10	17	17	
CLTE, 0 °C – 100 °C		HB	HB	V-0			UL 94
	PLC ⁽²⁾	3 ⁽³⁾	3 ⁽³⁾	1	4	2	
Flammability, 0.8 mm bar	PLC	4	4	4	4	4	UL 746A
Hot wire ignition, 0.8 mm bar	°C		875	875	850	960	IEC 695-2-1/3
Comparative tracking index	°F		1,607	1,607	1,562	1,760	
Glow wire ignitability temp, 0.8 mm bar		1.24	1.40	1.49	1.51	1.58	ISO 1183A
	%	0.30	0.20	0.10	0.45	0.39	
Specific gravity	%	0.7	0.3	0.2	0.4	0.3	ISO 294-4
Water absorption, 24 hours	g/10 min	6.5	6.5	6.5	6.0	4.5	
Mold shrinkage	%	0.4	0.5	0.5	0.3	0.3	ISO 294-4
Melt flow	%	0.6	1.0	1.0	0.6	1.3	

⁽¹⁾ Actual properties of individual batches will vary within specification limits.

⁽²⁾ PLC = Performance Level Category. Best performance assigned to category 0.

⁽³⁾ Measured using a 1.5-mm bar.



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