

Amodel[®]



SOLVAY

asking more from chemistry[®]

Amodel[®] PPA
polyphthalamide

**SPECIALTY
POLYMERS**



Designed to Thrive Where Only the Strong Survive

Amodel® PPA is remarkably stable at high temperatures and retains its excellent mechanical and electrical properties in high humidity and chemically aggressive environments.



Amodel® PPA delivers the performance you need when standard nylons are not enough:

- Higher strength and stiffness at elevated temperatures
- Better retention of properties in humid environments
- Greater resistance to a broader range of chemicals



Designed for Success

Design engineers and processors in a variety of industries specify Amodel® PPA to meet the demanding requirements of critical components in tough environments.

Automotive and Transportation

Components found under the hood of a vehicle must withstand a punishing environment that may include high temperatures, humidity and exposure to aggressive chemicals. Typical applications include control system enclosures, housings for water pumps, thermostats and electronic valve pumps, oil coolers, water pump impellers, heater core end caps, snap-fit electrical terminals and molded-in-place gaskets.

Electrical and Electronics

Amodel® PPA's excellent electrical properties make it ideal for connectors, switches and other applications where it functions as an electrical insulator. Additional applications include controller housings and components used in electrical motors.

Flame-retardant grades are compatible with SMT processing such as infrared reflow and vapor phase soldering, and halogen-free flame-retardant (HFFR) grades are available. Light-stabilized, high-reflectivity white PPA grades have been optimized for reflector cups used to manufacture LEDs.



Amodel® PPA Product Line

Our broad family of Amodel® PPA resins is built on three main base resins, each offering distinct product and processing features. Glass fibers, impact modifiers, minerals and other materials are compounded with these base resins to create an extensive selection of grades that offer a wide range of cost and performance options.

Amodel® PPA base resins

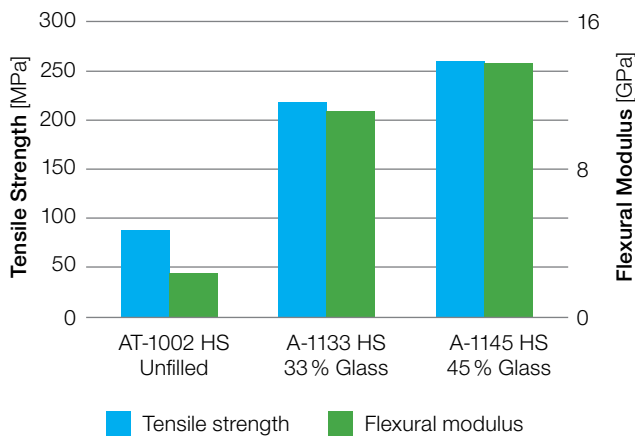
Base Resin	Processing	Description	Glass Transition Temperature		Melting Temperature	
			°C	°F	°C	°F
1000 Series	Hot oil moldable (mold temp > 135 °C)	Delivers the highest long-term thermal performance. High-flow HFZ grades available.	123	253	313	595
4000 Series	Hot water moldable (mold temp < 100 °C)	Provides the fastest crystallization for short cycle times. Compatible with SMT processing. High-flow HFZ grades available.	100	212	325	617
6000 Series	Hot water moldable (mold temp < 100 °C)	Excellent processing characteristics and surface appearance.	88	190	310	590

Glass Fiber Reinforced Grades

Glass fiber reinforcement significantly improves strength and stiffness, short-term thermal properties, and long-term resistance to creep and fatigue. Glycol-resistant grades are available.

Strength and stiffness comparison

ASTM test method

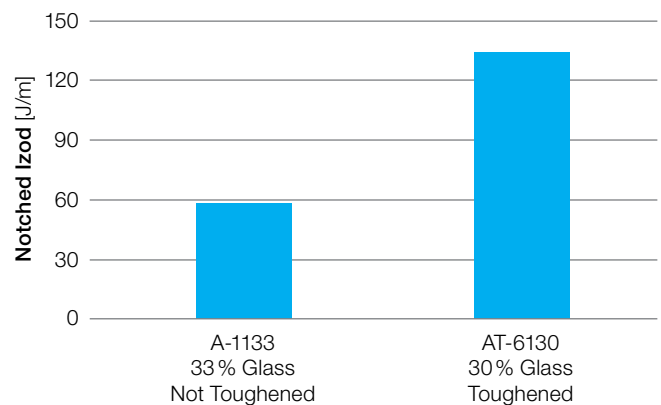


Impact Modified Grades

Toughened Amodel® PPA grades are compounded with impact modifiers to increase impact resistance. Unfilled toughened grades offer higher impact resistance than glass fiber reinforced grades.

Improved impact resistance

ASTM test method

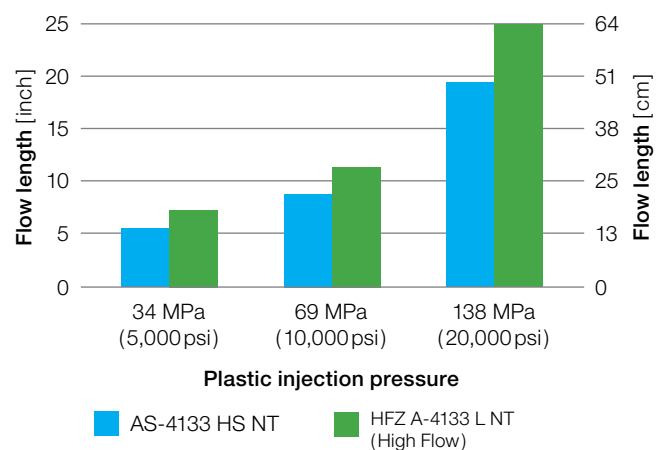


High-Flow Grades

Amodel HFZ grades improve molding of thin-walled, complex parts such as electronic components.

Spiral flow of Amodel® PPA

Tested at a thickness of 1.6 mm (0.064 inch)



Mineral and Mineral/Glass Fiber Reinforced Grades

Minerals reduce warpage and differential shrinkage, resulting in more uniform parts with dimensional stability.

Coefficient of Linear Thermal Expansion (CLTE)

ASTM Test Method

Grade	0 °C to 100 °C		100 °C to 200 °C	
	Flow	Transverse	Flow	Transverse
Amodel® A-1133 HS, 33 % glass, without mineral	24	55	27	115
Amodel® AS-1566 HS, 66 % glass, with mineral	17	40	17	72

Units: ppm/°C

Flame-Retardant Grades

Flame retardant grades are compatible with SMT processing techniques such as infrared reflow and vapor phase soldering. Halogen-free flame retardant (HFFR) grades are available.

UL 94 Rating and Relative Thermal Index (RTI)

Grade	Thickness [mm]	UL 94 Rating	Relative Thermal Index		
			Electrical	Mechanical with Impact	Mechanical without Impact
Amodel® AFA-4133 V0 Z	0.75	V-0	130 °C	130 °C	130 °C
	1.5	V-0	130 °C	130 °C	130 °C
	3.0	V-0	130 °C	130 °C	130 °C
Amodel® AFA-6133 V0 Z	0.75	V-0	130 °C	130 °C	130 °C
	1.5	V-0	130 °C	130 °C	130 °C
	3.0	V-0	130 °C	130 °C	130 °C

Electrical Grades

Amodel® PPA's outstanding electrical properties make it ideal for use in connectors, switches and other electrical and electronic applications requiring the material to be used as an electrical insulator.

Electrical properties

Grade	Minimum Thickness, mm	Hot Wire Ignition	High-Current Arc Ignition	High-Voltage Arc Tracking	Comparative Tracking Index
Amodel® AFA-6133 V0 Z 33 % glass filled, flame retardant	0.75	0	0	1	1

UL performance class ratings vary for each property; visit www.ul.com for definitions.



Get The Performance You Need

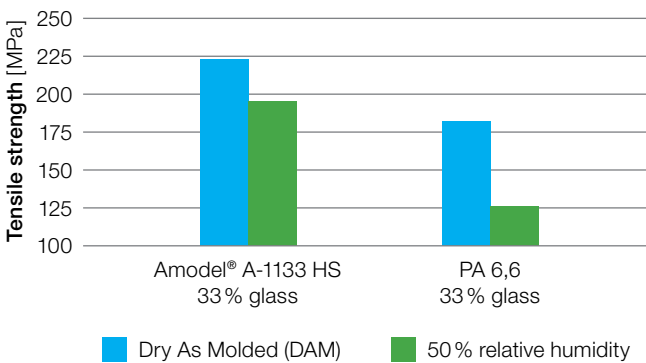
Amodel® PPA's broad product family gives you numerous ways to optimize performance, processing and price. Their exceptional thermal, mechanical and electrical properties make them suitable for a wide range of demanding applications including high-temperature automotive applications, housings for high-temperature electrical connectors, LED reflectors, electric and electronic devices and telecommunications.

Lower Moisture Absorption

Humid environments can have a devastating effect on the mechanical properties of standard nylons. Amodel® PPA's lower water absorption rate results in significantly less change in strength and stiffness, even with high levels of humidity.

Effects of moisture on tensile strength

ASTM test method

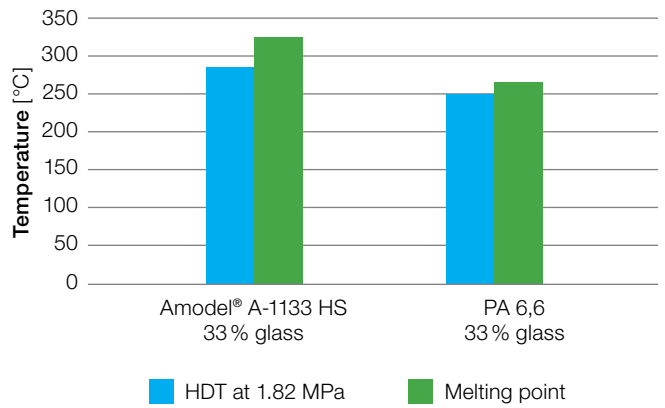


Higher Heat Resistance

Amodel® PPA boasts heat deflection temperatures (HDT) up to 310 °C (590 °F) and continuous-use temperatures from 120 °C to 185 °C (248 °F to 365 °F). This makes Amodel® PPA an excellent candidate for replacing metal in high-temperature automotive applications.

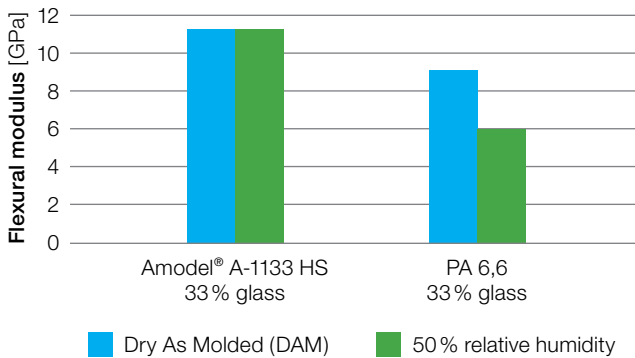
Thermal properties comparison

ASTM test method



Effects of moisture on flexural modulus

ASTM test method



Resistant to Fuels, Glycols and Harsh Chemicals

Amodel® PPA's highly aromatic ring structure provides greater resistance to a broader range of chemicals than standard, linear aliphatic nylons, even at high temperatures. This enables automotive, electrical and industrial components to withstand prolonged exposure to harsh chemicals:

- Bio-diesel fuel
- Brake fluid
- Calcium chloride
- Glycols
- Synthetic motor oil
- Road salt
- Transmission fluid
- Zinc chloride

Chemical resistance

Reagent	Condition	Amodel® AT-1002 HS ⁽¹⁾	POM ⁽²⁾	PA 6,6
Hydrochloric acid, 5 % to 10 %	23 °C / 1,000 hrs	Excellent	Unsatisfactory	Unsatisfactory
Nitric acid, 5 % to 10 %	23 °C / 1,000 hrs	Excellent	Unsatisfactory	Unsatisfactory
Sulfuric acid, 5 % to 10 %	23 °C / 1,000 hrs	Excellent	Unsatisfactory	Acceptable
Sulfuric acid, 30 % to 36 %	40 °C / 200 hrs	Excellent	Unsatisfactory	Unsatisfactory
Sulfuric acid, 30 % to 36 %	23 °C / 1,000 hrs	Excellent	Unsatisfactory	Unsatisfactory
Hydrofluoric acid, 1 % to 5 %	23 °C / 1,000 hrs	Acceptable	Unsatisfactory	Unsatisfactory
Zinc chloride, 50 %	23 °C / 200 hrs	Excellent	Unsatisfactory	Unsatisfactory
Eagle one chrome wheel cleaner	23 °C / 200 hrs	Excellent	Unsatisfactory	Unsatisfactory

⁽¹⁾ Unfilled, toughened and heat stabilized

⁽²⁾ Polyoxymethylene

Typical Properties

Typical properties of select Amodel® PPA grades

ASTM test method

Property	Units	Glass Filled		Structural*		Toughened		Flame Retardant
		A-1133 HS 33 % GF	A-1145 HS 45 % GF	AS-4145 HS 45 % GF	AS-1566 HS 66 % GF, Mineral	AT-1002 HS Unfilled	AT-6130 HS 30 % GF	AFA-6133 V0 Z 33 % GF
Tensile strength	MPa	233	259	224	200	83	170	186
	kpsi	33.8	37.5	32.5	29.0	12.1	24.6	27.0
Tensile modulus	GPa	13.4	17.2	16.1	22.8	2.8	9.3	14.5
	Mpsi	1.94	2.5	2.34	3.26	400	1.35	2.10
Tensile elongation	%	2.5	2.6	2.2	1.4	11	2.8	1.6
Notched Izod [ISO test method]	kJ/m ²	8.8	10.3	10.0	6.6	13.0	13.0	8.0
	ft-lb/in ²	4.2	4.9	4.8	3.1	6.0	6.0	3.9
Un-notched Izod [ISO test method]	kJ/m ²	49	61	55	44	177	80	44
	ft-lb/in ²	23	29	26	21	84	38	21
HDT, 1.8MPa	°C	280	281	298	280	118	276	282
	°F	536	538	568	536	244	529	540
Specific gravity		1.48	1.59	1.55	1.84	1.13	1.34	1.68

* Recommended for applications with wall thicknesses greater than 3 mm.



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