SOLVAY

asking more from chemistry®

High-Performance Plastics for

Fuel Systems

SPECIALTY POLYMERS

Improve Fuel Economy & Reduce Emissions

Amodel® PPA is compatible with a wide variety of fuel blends and thrives in the much hotter, confined and stressed environments created by today's engines.

Ixef® PARA is enabling a new technology designed to help small engine fuel tank manufacturers more cost-effectively meet CARB and EPA standards.

The global need to reduce evaporative emissions along with changes in fuel formulations have sparked a strong interest in higher-performing plastics for use in automotive and other fuel-burning engines.



Amodel® polyphthalamide (PPA) and Ixef® polyarylamide (PARA) are high-performance, semi-aromatic polyamides that combine inherent barrier and fuel resistance properties with other performance attributes.

- Ultra-low permeation
- Biodiesel and flex fuel compatibility
- Long-term fuel contact from 60 °C–125 °C
- Continuous use from 120 °C–185 °C
- Electrostatic dissipation
- Resistance to automotive fluids, cleaners and road salts
- Injection molding, extrusion and blow molding grades

Focus on Innovation

At Solvay, we place a high value on helping our customers succeed. That's why we constantly challenge ourselves to develop innovative products and technologies that help you stay ahead of the competition.

Ixef® BXT 2000-0203 marks a breakthrough in co-processing technology that could forever change how multi-layer barrier systems are used in fuel system components as well as fuel containment and delivery. Developments in high-temperature co-extrusion and thermoforming are also underway.

Amodel® Polyphthalamide (PPA)

For over 20 years, Amodel® PPA has successfully replaced metal in fuel system components where heat is a major consideration. With an HDT of 280 °C, it is remarkably stable at high temperatures and retains its excellent mechanical and electrical properties in high humidity and chemically aggressive environments.

Key Features

- High strength and stiffness
- Ultra-low permeation
- Biodiesel and flex fuel compatibility
- Long-term fuel contact from 60 °C–125 °C
- Continuous use from 120 °C–180 °C
- Resistance to automotive fluids, cleaners and road salts
- ESD and toughened grades available

Typical Applications

- Fuel flanges
- Rollover valves
- Quick connects
- Filter housings
- Fuel rails
- Sender units
- Throttle bodies
- Carburetors

Amodel® PPA injection molding grades

AT-1002 HS	Toughened, unfilled, good ductility
AT-1116 HS	Toughened, 16 % glass fiber
AS-1133 HS	General purpose, 33 % glass fiber
AS-1145 HS	Structural for thick-wall parts, 45 % glass fiber
A-1625 HS	Conductive for electrostatic dissipation

Grades shown are for oil-cooled molding. Additional grades are available for oil-cooled and water-cooled molding.

Superior Compatibility

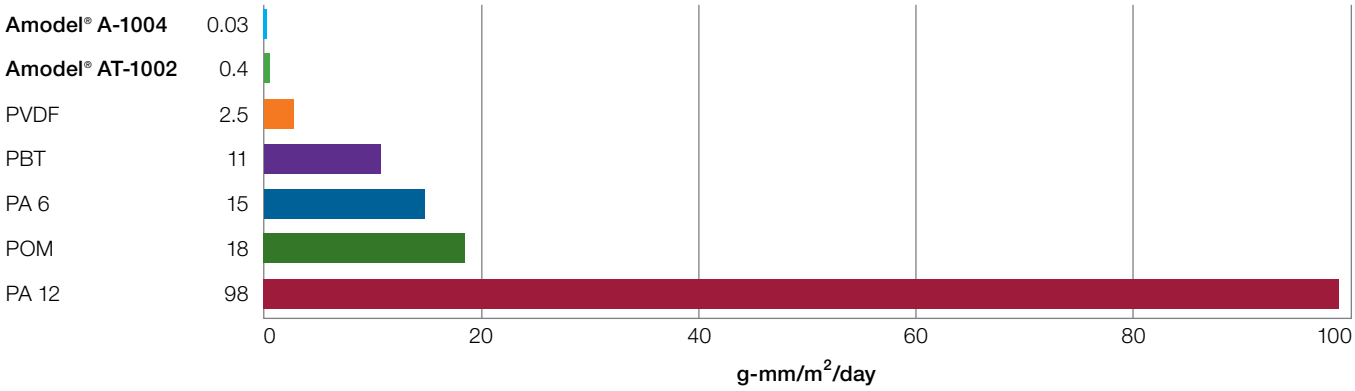
The compatibility of Amodel® PPA with many current and potential future fuel blends was evaluated in extensive laboratory testing. This included exposure to biodiesel, diesel, diesel with aggressive water for 6,000 hours at 125 °C (to simulate under-the-hood conditions), Fuel C, flex fuels and auto-oxidized fuels for 5,000 hours at 60 °C (to simulate fuel tank conditions).

Amodel® PPA showed low weight gain, little dimensional change and excellent retention of mechanical properties, indicating excellent compatibility with diesel, B20 SME, B50 RME, Fuel C, CE10 and CM15.

Please contact your Solvay representative for detailed test results.

Average permeability rates over 28 days

CE10 Fuel (90 % Fuel C, 10 % Ethanol) at 60 °C



Chemical compatibility

	Test Conditions	Amodel® AT-1002	POM	PA 6,6
Hydrochloric acid, 5–10 %	23 °C, 1,000 hrs	Excellent	Poor	Poor
Hydrofluoric acid, 1–5 %	23 °C, 1,000 hrs	Good	Poor	Poor
Nitric acid, 5–10 %	23 °C, 1,000 hrs	Excellent	Poor	Poor
Sulfuric acid, 5–10 %	23 °C, 1,000 hrs	Excellent	Poor	Good
Sulfuric acid, 30–36 %	23 °C, 1,000 hrs	Excellent	Poor	Poor
Sulfuric acid, 30–36 %	40 °C, 200 hrs	Excellent	Poor	Poor
Zinc chloride, 50 %	23 °C, 200 hrs	Excellent	Poor	Poor

Excellent: >85 % retention of tensile strength, no chemical attack and no stress cracking
Good: >50 % retention of tensile strength, no chemical attack and no stress cracking
Poor: chemical attack and stress cracking

Ixef® Polyarylamide (PARA)

Ixef® PARA is similar to Amodel® PPA in its exceptional barrier properties and compatibility with a variety of fuels. A key difference is the material's lower processing temperature, which has enabled a promising new multi-layer co-processing technology designed to help OEMs more cost-effectively meet regulatory requirements.

Key Features

- Ultra-low permeation
- Excellent impact resistance to –40 °C
- Direct contact with biodiesel and high ethanol fuels
- Two-layer and three-layer barrier technology
- Exceptional processing stability
- Low extractibles in alcohol-based fuels

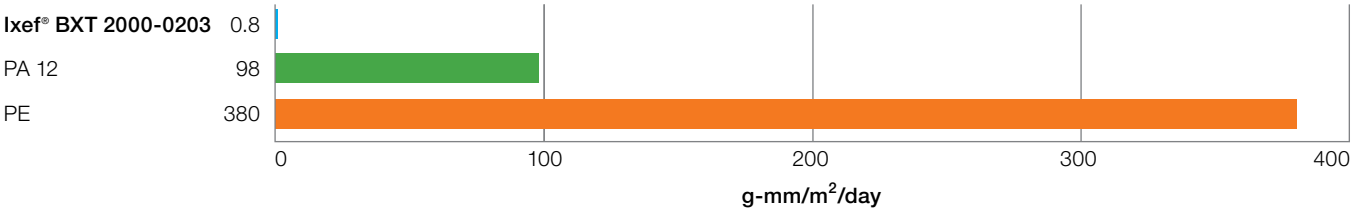
Typical Applications

- Small engine fuel tanks
- Fuel and vapor lines
- Filler tubes
- Storage containers
- Sheet and film

Ixef® PARA for extrusion & blow molding

BXT 2000-0203	Toughened, unreinforced. New formulation offers lower processing temperature, higher flow and wider processing window.

Average permeability rates over 28 days
CE10 Fuel (90 % Fuel C, 10 % Ethanol) at 60 °C



When exposed to CM15 fuel for 5,000 hours at 60 °C, Ixef® BXT 2000-0203 showed low weight gain, little dimensional change and excellent retention of mechanical properties. Additional testing to confirm the material's long-term compatibility with Fuel C, CE10, CE85, B20 SME, B20 RME and No. 2 diesel are near completion.

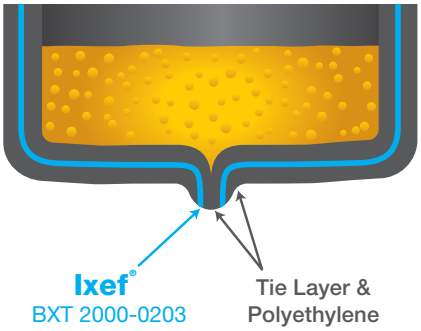
CARB & EPA Approved for Small Engine Fuel Tanks

Ixef® BXT 2000-0203 is approved by the California Air Resources Board (CARB) and the U.S. Environmental Protection Agency (EPA) as a barrier solution for three-layer fuel tank systems for small-engine fuel tanks such as lawnmowers, snow blowers, weed trimmers and generators.

CARB executive order Q-08-025 allows OEMs to use the material without needing to undergo costly and lengthy tank permeation testing. Fuel tanks using this three-layer design have also been approved by EPA.

Three-layer Tanks Reduce Cost and Complexity

Three-layer HDPE/Ixef® PARA fuel tanks meet barrier requirements while offering simplified processing, reduced equipment and tooling requirements, and lower cost vs. traditional co-extruded five-layer HDPE/EVOH tanks. They also have better cold weather durability, delivering excellent impact resistance to –40 °C (SAE J233).

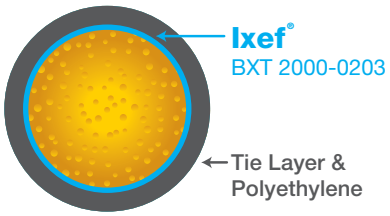


HDPE/Ixef® PARA tanks are also less expensive than fluorinated tanks and monolayer tanks, which contain more expensive barrier additives.

Ixef® BXT 2000-0203 resin exceeds the new EPA regulation for Fuel CE10 and the current CARB TP901 standard, which limits fuel vapor emissions to 1.5 $g/m^2/day$ for small off-road engines. The material also maintains its mechanical properties in new fuels such as biodiesel and ethanol-based mixtures. Unlike EVOH, which is limited to continuous-extrusion blow molding, Ixef® BXT 2000-0203 can be run on both accumulator and continuous-extrusion machines. For blow molded HDPE/Ixef® PARA tanks, no purging is required and changeovers on both machines are quicker and less costly than with EVOH.

Chemical Resistance Enables Two-layer Technology

Ixef® BXT 2000-0203 can also be used in two-layer barrier structures such as fuel lines, filler pipes and low-permeation fuel hoses because of its ability to withstand direct contact with fuel.



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