SOLVAY

Progress beyond

The tough, lightweight alternative to Glass for Consumer Appliances

Benefits of Utilizing Specialty Polymers

The Solvay Team

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Agenda

Dilemma of selecting alternative to glass – properties and comparative performance

Benefits of utilizing specialty polymers

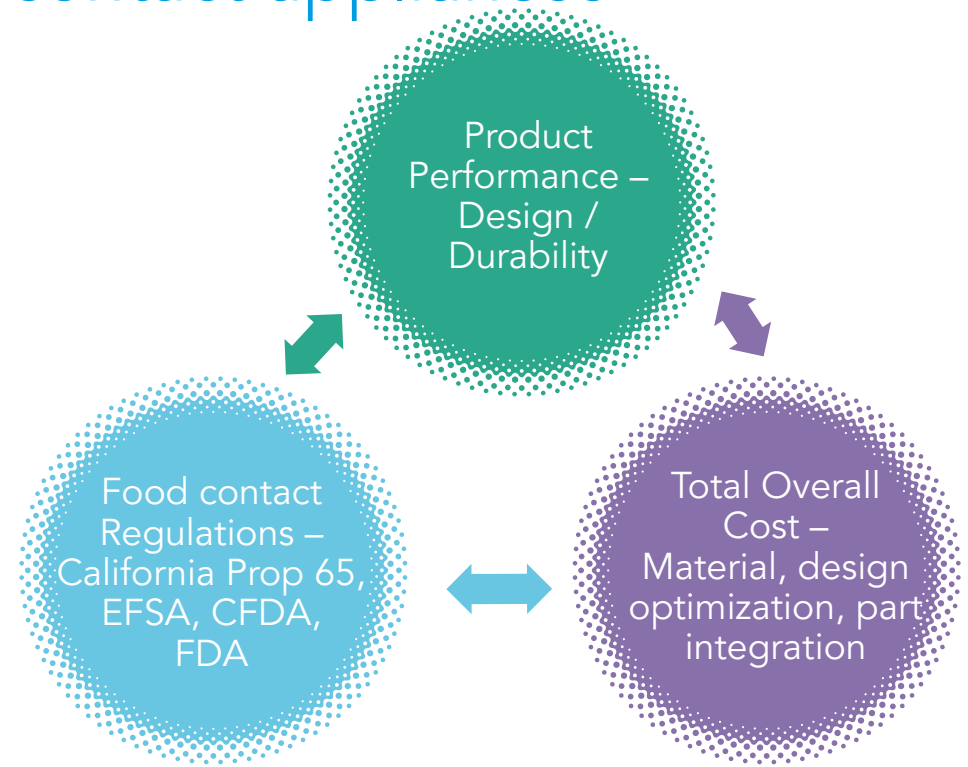
Real world applications case studies
Case study 1 - Countertop appliances, Catering and Tableware
Case study 2 - Baby products
Case study 3 - Beverage vending

Key factors to success

Working with Solvay

Conclusion and Q&A

Meeting the challenges in Consumer Food contact appliances



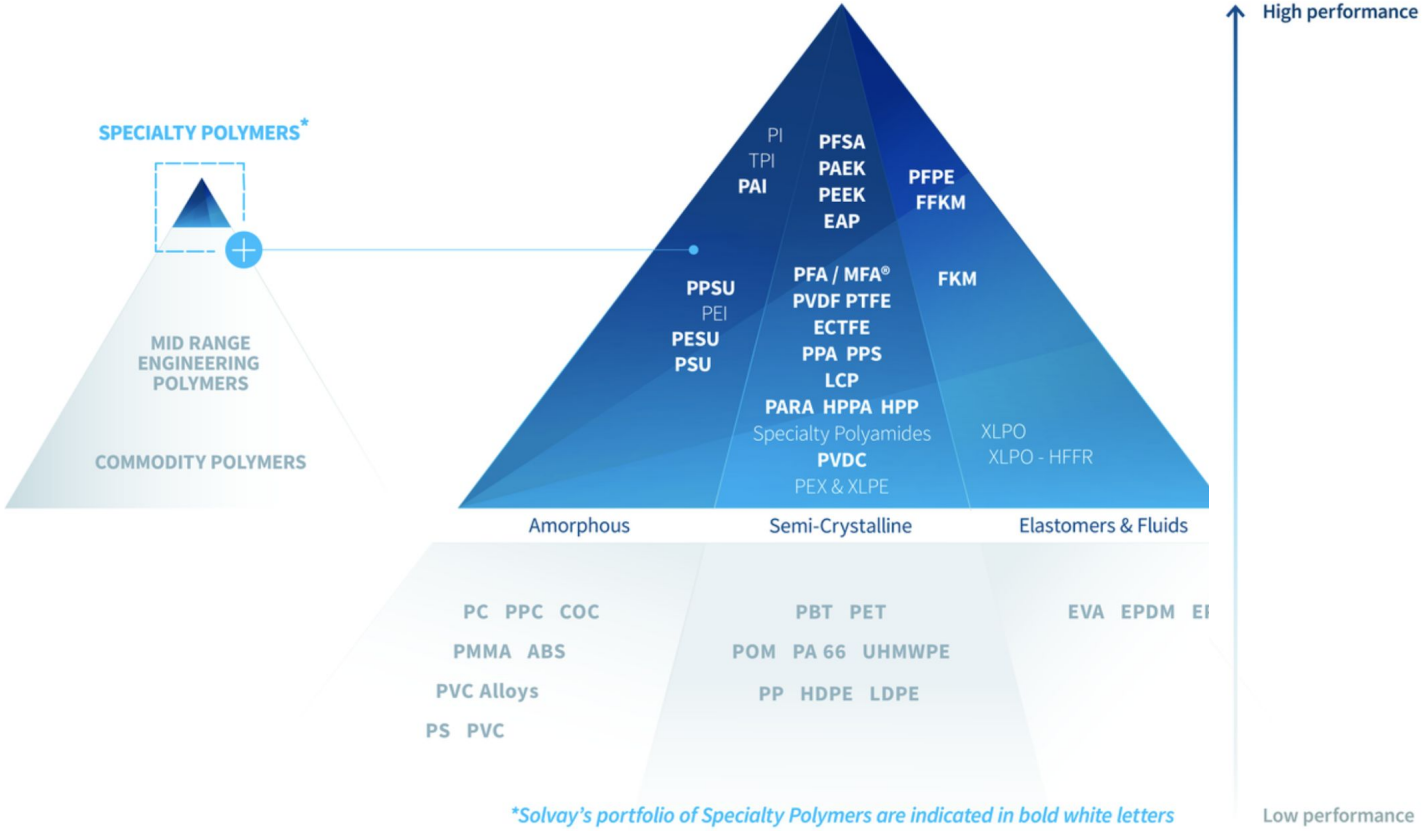
The tough, lightweight alternative to glass

Material selection criteria

Material selection criteria in Consumer Food contact applications

- Transparency & clarity
- Strength and stiffness
- Thermal stability
- Toughness and Impact resistance
- Resistance to chemical aggression (**Dishwasher safe**)
- **Sterilization** compatibility (Steam / boiling water)
- **Regulatory approvals (BPA-Free)**
- Design & processing (High flow / Molding criteria)

Top Tier Portfolio of Specialty Polymers



Broad solutions portfolio

	Amodel® PPA	Ixef® PARA	Omnix® HPPA	Kalix® HPPA	Ryton® PPS	Xydar® LCP	Xencor™ PARA, HPPA PPA, PPS	Udel® PSU	Veradel® PESU	Radel® PPSU	KetaSpire® AvaSpire PEEK, PEAK	Solef® PVDF
Chemistry	✓	✓	✓	✓	✓	✓	✓				✓	
Stiffness				✓			✓			✓	✓	
Creep	✓				✓	✓	✓				✓	
Inherently V-0					✓	✓	✓		✓	✓	✓	✓
Aesthetics		✓					✓	✓	✓	✓		
High colorability	✓	✓	✓	✓			✓	✓	✓	✓		
Transparency								✓	✓	✓		
Water & Steam	✓				✓	✓	✓	✓	✓	✓	✓	✓
Temperature	✓				✓	✓	✓		✓	✓	✓	
F&W							✓				✓	✓
Food Contact	✓	✓	✓		✓			✓	✓	✓	✓	✓
Injection molding	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Extrusion		✓			✓			✓	✓	✓	✓	✓

Transparent high-performance polymers (HPPs) in Consumer Goods space

	Countertop Appliances*	Large Home Appliances	HT Catering & Tableware	Baby Products (BPA-Free)
Radel® PPSU	✔	✔	✔	✔
Veradel® PESU	✔	✔	✔	✔
Udel® PSU	✔	✔		
PC	✔	✔		
PET		✔	✔	✔
PEI	✔	✔	✔	

Polymers vs Glass: Performance Overview

	Attributes	Glass	Polymers
Sustainability & Design	Weight (density)	–	+
	Design freedom	–	+
Properties	Isotropic properties	+	–
	Strength/stiffness	-	+
	Properties temperature /time dependent	+	–
	Chemical resistance (+ corrosion)	+	+
	Thermal conductivity / insulation	-	+
	Electrical conductivity / insulation	+	+
	Electromagnetic shielding	+	–
	Friction/wear	+ /–	+ /–
	Transparency	+	+/-
Post processing	Secondary operations (if needed)	–	+
	Dimensional stability/tolerances	-	–
Cost elements	Fluctuating market price	+	+
	Cost	+/–	+/–
Market specific elements	Food contact	+	+/–
	Biocompatibility	-	+/–

Case Study 1: Small Appliances and Serving Trays

Application:
Transparent food / water contact parts for coffee machines (carafes), food processors and juicers, high temperature food serving trays for commercial and home use

Material:
Veradel® PESU A-301 NT / Radel® PPSU R-5000 NT

Processing method:
Injection molding

Main Value Proposition:

- Chemical resistance to aggressive food material (Coffee…)
- High temperature resistance of >180C for processors
- Food contact approvals globally (BPA-free)
- Lightweight and shatterproof vs Glass
- Transparent - tinted colors available
- Opaque colors with good stability
- Dishwasher safe
- No smell & Taste migration

Case Study 2: Baby products

Application:
Transparent food contact approved / BPA free baby bottles

Material:
Radel® PPSU R-5000 NT / Veradel® PESU A-101 / 201 / 301 NT

Processing method:
Blow molding

Main Value Proposition:

- Food contact approvals globally (BPA-free)
- Resistance to hot water sterilization
- Shatterproof vs Glass
- Exceptional toughness
- Transparency
- Significantly lower deformations at high temperatures Vs other polymers such as CPET

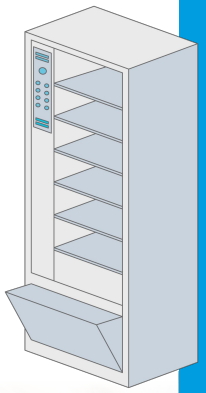
Source: Press release

Case Study 2: Beverage vending

Application:
Valves / Coffee pressure drip-heads / connectors in Beverage Vending Machines

Material:
Material: Radel® PPSU R-5000 / Veradel® PESU A301 NT / Udel® PSU P1700

Processing method:
Injection Molding



Main Value Proposition:

- Food contact approvals globally
- Functional part integration Vs Metals
- Resistance to hot water contact and dimensional stability
- High temperature resistance of >150C for professional hot beverage makers (possibility of thinner wall molding for high temperature applications)
- Lightweight and shatterproof

A balanced presence to better serve our customers

2020 figures

NORTH AMERICA

- 28% of net sales
- 39 industrial sites
- 24% of Group employees
- 7 major R&I centers

EUROPE

- 29% of net sales
- 40 industrial sites
- 48% of Group employees
- 8 major R&I centers

LATIN AMERICA

- 11% of net sales
- 7 industrial sites
- 10% of Group employees
- 1 major R&I center

ASIA PACIFIC

& Rest of the world*

- 32% of net sales
- 24 industrial sites
- 18% of Group employees
- 4 major R&I centers

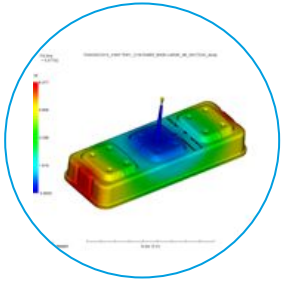
*includes Middle-East and Africa

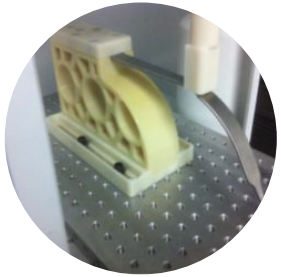
Customer Excellence through Application Engineering

We are your partner in the commercial journey providing added value with specialty polymers

Our expertise Wide and differentiated portfolio, Consumer market expertise, Clearly laid out life cycle view

Solution proposal	Prototyping	Mold Design, Definition and Testing	Part processing Support	Field follow up and Support
Material solutions that enhance the overall value for the customer	Virtual: expertise in Software based quick overview of application performance	Mold and part design review Implementation of specific customer testing procedures	On-site support during processing (molding, extrusion) trials	QC review and failure analysis (fractography, IR, etc)





Residual Stress Cracks on Molded Part

Questions?

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