General information

Ansys Name	Plastic, ASA

Designation

Acrylate styrene acrylonitrile (alternative name: acrylonitrile styrene acrylate) (Extrusion, Injection and Blow Molding)

Tradenames

Abel; Accucomp; Alcom; Altech; Astalac; Badalac; Centrex; Dialac; Diamaloy; Diamond; Dynacom; Envirosun; Geloy; Hifill; Hysun; Jamplast; Kibilac; Kingfa; Kumhosunny; LG; Luran; Nilsan; Omnitech; Polyasa; Polyfast; Polyman; Ramshine; Resmart; Ronfalin; Rotec; Saxatec; Shinko-Lac; Spartech; Starex; Tairilac; Techno; Terez; Unibrite; Vitax

Typical uses

Outdoor signs, exterior panels, garden furniture

Included in Materials Data for Simulation	✓

Composition overview

Compositional summary

Block terpolymer acrylonitrile, styrene, and acrylate rubber

Material family	Plastic (thermoplastic, amorphous)
Base material	ASA (Acrylonitrile styrene acrylate)
Polymer code	ASA

Composition detail (polymers and natural materials)

Polymer	100			%

Price

Price	*	1.97	-	2.11	CHF/kg
Price per unit volume	*	2.07e3	-	2.24e3	CHF/m^3

Physical properties

Density		1.05e3	-	1.06e3	kg/m^3

Mechanical properties

Young's modulus	*	1.51	-	2.34	GPa
Specific stiffness	*	1.43	-	2.22	MN.m/kg
Yield strength (elastic limit)		35.9	-	38.6	MPa
Tensile strength		27.6	-	51.7	MPa
Specific strength	*	34	-	36.6	kN.m/kg
Elongation		25	-	40	% strain
Compressive modulus	*	1.51	-	2.34	GPa
Compressive strength	*	43.1	-	46.3	MPa
Flexural modulus		1.51	-	2.34	GPa
Flexural strength (modulus of rupture)		41.4	-	55.2	MPa
Shear modulus	*	0.538	-	0.833	GPa
Bulk modulus	*	3.2	-	3.36	GPa
Poisson's ratio	*	0.397	-	0.413	
Shape factor		5.3			
Hardness - Vickers	*	11	-	12	HV

Hardness - Rockwell M	* 51	-	56	
Hardness - Rockwell R	85	-	90	
Elastic stored energy (springs)	* 294	-	463	kJ/m^3
Fatigue strength at 10^7 cycles	14.3	-	15.8	MPa

Impact & fracture properties

Fracture toughness	* 1.52	-	4.57	MPa.m^0.5
Toughness (G)	* 1.49	-	9.19	kJ/m^2
Impact strength, notched 23 °C	11.5	-	34.5	kJ/m^2
Impact strength, notched -30 °C	1.82	-	4.79	kJ/m^2
Impact strength, unnotched 23 °C	111	-	133	kJ/m^2
Impact strength, unnotched -30 °C	38.7	-	189	kJ/m^2

Thermal properties

Melting point	220	-	260	°C
Glass temperature	101	-	116	°C
Heat deflection temperature 0.45MPa	93	-	99	°C
Heat deflection temperature 1.8MPa	85	-	88	°C
Vicat softening point	91	-	111	°C
Maximum service temperature	53	-	67	°C
Minimum service temperature	* -51	-	-31	°C
Thermal conductivity	* 0.236	-	0.246	W/m.°C
Specific heat capacity	* 1.68e3	-	1.75e3	J/kg.°C
Thermal expansion coefficient	104	-	108	µstrain/°C
Thermal shock resistance	* 149	-	233	°C
Thermal distortion resistance	* 0.00221	-	0.00233	MW/m

Electrical properties

Electrical resistivity	1e19	-	1e20	µohm.cm
Electrical conductivity	1.72e-18	-	1.72e-17	%IACS
Dielectric constant (relative permittivity)	3.2	-	3.5	
Dissipation factor (dielectric loss tangent)	0.023	-	0.027	
Dielectric strength (dielectric breakdown)	18.5	-	20.1	MV/m
Comparative tracking index	600			V

Magnetic properties

Magnetic type	Non-magnetic

Optical, aesthetic and acoustic properties

Transparency	Opaque			
Acoustic velocity	* 1.19e3	-	1.5e3	m/s
Mechanical loss coefficient (tan delta)	* 0.0171	-	0.0265	

Restricted substances risk indicators

SIN List indicator (0-1, 1 = high risk)	0

Critical materials risk

Contains >5wt% critical elements?	No

Absorption & permeability

Water absorption @ 24 hrs	0.2	-	0.3	%
Water vapor transmission	2.91	-	3.61	g.mm/m².day
Permeability (O2)	15.1	-	58.4	cm³.mm/m².day.atm

Processing properties

Polymer injection molding	Acceptable			
Polymer extrusion	Excellent			
Polymer thermoforming	Acceptable			
Linear mold shrinkage	0.4	-	0.6	%
Melt temperature	193	-	243	°C
Mold temperature	50	-	70	°C
Molding pressure range	61.9	-	103	MPa

Durability

Water (fresh)	Excellent			
Water (salt)	Excellent			
Weak acids	Acceptable			
Strong acids	Limited use			
Weak alkalis	Excellent			
Strong alkalis	Acceptable			
Organic solvents	Unacceptable			
Oxidation at 500C	Unacceptable			
UV radiation (sunlight)	Good			
Flammability	Highly flammable			
Oxygen index	18	-	20	%

Chemical resistance of polymers

Chemical resistance, data sources

Derived from Rapra ChemRes record for ASA

Acetic acid (10%)	Satisfactory
Acetic acid (glacial)	Unsatisfactory
Acetone	Unsatisfactory
Acetophenone	Unsatisfactory
Aluminum chloride (10%)	Satisfactory
Aluminum sulfate	Satisfactory
Ammonium hydroxide (35%)	Probably satisfactory
Ammonium sulfate (50%)	Satisfactory
Amyl acetate	Unsatisfactory
Amyl alcohol	Satisfactory
Aniline	Unsatisfactory
Antimony trichloride (10%)	Probably satisfactory
Aqua regia	Limited
Arsenic acid	Probably satisfactory
ASTM fuel A	Probably satisfactory
Barium chloride	Satisfactory
Benzaldehyde	Unsatisfactory

Benzene	Unsatisfactory
Benzyl alcohol	Unsatisfactory
Benzyl chloride	Doubtful
Boric acid	Satisfactory
Brake fluid	Unsatisfactory
Bromine liquid	Unsatisfactory
Butane	Satisfactory
Butyl acetate	Unsatisfactory
Butyl alcohol (butanol)	Limited
Butyl chloride	Doubtful
Butyric acid	Unsatisfactory
Calcium chloride	Satisfactory
Carbon disulfide	Unsatisfactory
Carbon tetrachloride	Unsatisfactory
Castor oil	Satisfactory
Chloracetic acid	Doubtful
Chlorine dioxide	Doubtful
Chlorine gas (dry)	Unsatisfactory
Chlorine water	Limited
Chlorobenzene	Unsatisfactory
Chloroform	Unsatisfactory
Chlorosulfonic acid	Unsatisfactory
Chromic acid	Doubtful
Citric acid (10%)	Satisfactory
Cod liver oil	Satisfactory
Copper sulfate	Satisfactory
Cotton seed oil	Satisfactory
Cresols	Limited
Cyclohexane	Probably satisfactory
Cyclohexanol	Probably satisfactory
Cyclohexanone	Unsatisfactory
Decalin	Doubtful
Diesel oil	Satisfactory
Diethyl ether	Unsatisfactory
Diethylene glycol	Satisfactory
Dimethyl formamide	Unsatisfactory
Dioctyl phthalate	Doubtful
Dioxane	Unsatisfactory
Ethyl acetate	Unsatisfactory
Ethyl alcohol (ethanol)	Probably satisfactory
Ethyl chloride	Unsatisfactory
Ethylene bromide	Doubtful
Ethylene chloride (1,2 dichloroethane)	Unsatisfactory
Ethylene glycol	Satisfactory
Ferric chloride	Satisfactory
Fluoboric acid	Limited
Fluorine (gas)	Doubtful

Fluosilicic acid	Limited
Formaldehyde (40%)	Probably satisfactory
Formic acid (90%)	Limited
Freon - 11	Limited
Freon - 113	Limited
Freon - 12	Limited
Freon - 21	Unsatisfactory
Freon - 22	Unsatisfactory
Furfural	Unsatisfactory
Glycerol	Satisfactory
Hexane	Satisfactory
Hydrobromic acid (50%)	Limited
Hydrochloric acid (10%)	Probably satisfactory
Hydrochloric acid (36%)	Limited
Hydrofluoric acid (40%)	Limited
Hydrogen sulfide gas	Probably satisfactory
Iso-octane	Satisfactory
Iso-propyl alcohol (iso-propanol)	Probably satisfactory
Lactic acid (90%)	Probably satisfactory
Lead acetate (10%)	Satisfactory
Linseed oil	Satisfactory
Lubricating oil	Satisfactory
Magnesium chloride	Satisfactory
Manganese sulfate	Probably satisfactory
Mercuric chloride	Satisfactory
Methyl alcohol (methanol)	Limited
Methyl bromide (gas)	Doubtful
Methyl ethyl ketone	Unsatisfactory
Methylene chloride (dichloromethane)	Unsatisfactory
Nickel chloride	Probably satisfactory
Nitric acid (10%)	Probably satisfactory
Nitric acid (70%)	Doubtful
Nitrobenzene	Unsatisfactory
n-propanol	Probably satisfactory
Oleic acid	Satisfactory
Olive oil	Satisfactory
Oxalic acid (solutions)	Satisfactory
Ozone (gas)	Satisfactory
Paraffin oil (kerosene)	Satisfactory
Perchlorethylene	Doubtful
Peroxymonosulfuric acid	Doubtful
Petrol (gasoline)	Limited
Phenol	Unsatisfactory
Phosphoric acid (85%)	Probably satisfactory
Picric acid (solutions)	Doubtful
Potassium cyanide	Probably satisfactory
Potassium fluoride	Satisfactory

Potassium hydroxide (50%)	Satisfactory
Potassium permanganate (25%)	Probably satisfactory
Potassium sulfate	Satisfactory
Propylene oxide	Unsatisfactory
Pyridine	Unsatisfactory
Rapeseed oil	Probably satisfactory
Silicone fluids	Satisfactory
Silver nitrate	Probably satisfactory
Sodium borate	Satisfactory
Sodium carbonate (10%)	Satisfactory
Sodium chloride (25%)	Satisfactory
Sodium chlorite	Probably satisfactory
Sodium cyanide	Probably satisfactory
Sodium hydroxide (10%)	Satisfactory
Sodium hydroxide (60%)	Probably satisfactory
Sodium hypochlorite (20%)	Satisfactory
Sodium nitrate	Satisfactory
Stannic chloride	Unsatisfactory
Styrene	Doubtful
Sulfuric acid (10%)	Satisfactory
Sulfuric acid (70%)	Limited
Sulfuric acid (96%)	Unsatisfactory
Sulfuric acid (fuming)	Doubtful
Tetrachlorethane	Unsatisfactory
Tetrahydrofuran	Unsatisfactory
Tetralin	Unsatisfactory
Thionyl chloride	Unsatisfactory
Titanium tetrachloride	Unsatisfactory
Toluene	Unsatisfactory
Transformer oil	Satisfactory
Trichlorethane	Unsatisfactory
Trichlorethylene	Unsatisfactory
Tricresyl phosphate	Unsatisfactory
Triethanolamine	Satisfactory
Turpentine	Limited
Vegetable oils (general)	Probably satisfactory
Vinyl acetate	Doubtful
Vinyl chloride	Doubtful
Water (distilled)	Satisfactory
Water (sea)	Satisfactory
Wine	Probably satisfactory
Xylene	Unsatisfactory
Zinc chloride (aq. sol.)	Satisfactory

Primary production energy, CO2 and water

Embodied energy, primary production (virgin grade)	* 96.9	-	107	MJ/kg
Embodied energy, primary production (typical grade)	* 96.8	-	107	MJ/kg

CO2 footprint, primary production (virgin grade)	* 4.63	-	5.1	kg/kg
CO2 footprint, primary production (typical grade)	* 4.63	-	5.1	kg/kg
Water usage	* 184	-	204	l/kg

Processing energy, CO2 footprint & water

Polymer extrusion energy	* 5.87	-	6.49	MJ/kg
Polymer extrusion CO2	* 0.44	-	0.487	kg/kg
Polymer extrusion water	* 4.85	-	7.27	l/kg
Polymer molding energy	* 20.1	-	22.2	MJ/kg
Polymer molding CO2	* 1.51	-	1.67	kg/kg
Polymer molding water	* 13.2	-	19.8	l/kg
Coarse machining energy (per unit wt removed)	* 0.877	-	0.97	MJ/kg
Coarse machining CO2 (per unit wt removed)	* 0.0658	-	0.0727	kg/kg
Fine machining energy (per unit wt removed)	* 4.5	-	4.97	MJ/kg
Fine machining CO2 (per unit wt removed)	* 0.337	-	0.373	kg/kg
Grinding energy (per unit wt removed)	* 8.52	-	9.42	MJ/kg
Grinding CO2 (per unit wt removed)	* 0.639	-	0.706	kg/kg

Recycling and end of life

Recycle	✓			
Embodied energy, recycling	* 32.9	-	36.3	MJ/kg
CO2 footprint, recycling	* 1.57	-	1.73	kg/kg
Recycle fraction in current supply	0.1			%
Downcycle	✓			
Combust for energy recovery	✓			
Heat of combustion (net)	* 36.2	-	38	MJ/kg
Combustion CO2	* 2.81	-	2.95	kg/kg
Landfill	✓			
Biodegrade	✗			

Notes

Other notes

Endurance limit tested at 10 Hz

Liens

Global Polymers Plastics

ProcessUniverse

Producers

Reference

Shape