General information

Designation

Poly Vinyl Chloride (Chlorinated, Molding and Extrusion); CPVC

Tradenames

Boltaron, Geon, Protherm, Unitec

Typical uses

Hot water piping; fibers;

Composition overview

Compositional summary

Compound of chlorinated PVC: (CH2CHCl)n with additional random substitution of H by Cl. 63-66% chlorine compared to 56.7% in standard PVC.

Material family	Plastic (thermoplastic, amorphous)
Base material	PVC-C (Polyvinyl chloride, chlorinated)
Polymer code	PVC-C

Composition detail (polymers and natural materials)

Polymer	100	%

Price

Price	3.07	USD/kg

Physical properties

Density	1.45e3	-	1.56e3	kg/m^3

Mechanical properties

Young's modulus	2.18	-	3.41	GPa
Yield strength (elastic limit)	53	-	58	MPa
Tensile strength	46	-	58	MPa
Elongation	20	-	50	% strain
Elongation at yield	4	-	7	% strain
Compressive modulus	* 2.18	-	3.41	GPa
Compressive strength	* 50	-	67	MPa
Flexural modulus	2.19	-	2.79	GPa
Flexural strength (modulus of rupture)	82	-	90	MPa
Shear modulus	* 0.776	-	1.22	GPa
Bulk modulus	* 4.28	-	4.49	GPa
Poisson's ratio	0.35	-	0.38	
Shape factor	5.3			
Hardness - Vickers	* 13.7	-	16.6	HV

Hardness - Rockwell M	* 71.9	-	90.4	
Hardness - Rockwell R	* 113	-	132	
Fatigue strength at 10^7 cycles	* 18.2	-	22.1	MPa
Mechanical loss coefficient (tan delta)	* 0.0122	-	0.017	

Impact & fracture properties

Fracture toughness	* 3.54	-	3.87	MPa.m^0.5
Impact strength, notched 23 °C	9.5	-	13.1	kJ/m^2
Impact strength, unnotched 23 °C	590	-	600	kJ/m^2

Thermal properties

Glass temperature	102	-	118	°C
Heat deflection temperature 0.45MPa	102	-	119	°C
Heat deflection temperature 1.8MPa	94	-	112	°C
Vicat softening point	* 102	-	119	°C
Maximum service temperature	85	-	100	°C
Minimum service temperature	* -51	-	-31	°C
Thermal conductivity	0.133	-	0.144	W/m.°C
Specific heat capacity	* 1.29e3	-	1.34e3	J/kg.°C
Thermal expansion coefficient	112	-	140	µstrain/°C

Electrical properties

Electrical resistivity	1e21	-	2e22	µohm.cm
Dielectric constant (relative permittivity)	3	-	3.2	
Dissipation factor (dielectric loss tangent)	0.0189	-	0.0208	
Dielectric strength (dielectric breakdown)	23.6	-	24.6	MV/m

Magnetic properties

Magnetic type	Non-magnetic

Optical properties

Transparency	Opaque

Absorption & permeability

Water absorption @ 24 hrs	0.02	-	0.15	%
Permeability (O2)	3.49	-	6.96	cm³.mm/m².day.atm

Processing properties

Polymer injection molding	Acceptable			
Polymer extrusion	Acceptable			
Polymer thermoforming	Acceptable			
Linear mold shrinkage	0.3	-	0.7	%

Melt temperature	182	-	227	°C
Mold temperature	40	-	70	°C
Molding pressure range	103	-	275	MPa

Durability

Water (fresh)	Excellent
Water (salt)	Excellent
Weak acids	Excellent
Strong acids	Excellent
Weak alkalis	Excellent
Strong alkalis	Excellent
Organic solvents	Limited use
Oxidation at 500C	Unacceptable
UV radiation (sunlight)	Good
Flammability	Self-extinguishing

Primary production energy, CO2 and water

Embodied energy, primary production	49.3	-	54.4	MJ/kg
Sources				
51.8 MJ/kg (Franklin Associates,				
CO2 footprint, primary production	* 1.78	-	1.97	kg/kg
Water usage	* 198	-	219	l/kg

Processing energy, CO2 footprint & water

Polymer extrusion energy	* 5.74	-	6.35	MJ/kg
Polymer extrusion CO2	* 0.431	-	0.476	kg/kg
Polymer extrusion water	* 4.79	-	7.19	l/kg
Polymer molding energy	* 16.4	-	18.2	MJ/kg
Polymer molding CO2	* 1.23	-	1.36	kg/kg
Polymer molding water	* 11.7	-	17.5	l/kg
Coarse machining energy (per unit wt removed)	* 0.841	-	0.929	MJ/kg
Coarse machining CO2 (per unit wt removed)	* 0.063	-	0.0697	kg/kg
Fine machining energy (per unit wt removed)	* 4.13	-	4.57	MJ/kg
Fine machining CO2 (per unit wt removed)	* 0.31	-	0.342	kg/kg
Grinding energy (per unit wt removed)	* 7.79	-	8.61	MJ/kg
Grinding CO2 (per unit wt removed)	* 0.584	-	0.645	kg/kg

Recycling and end of life

Recycle	✔			
Embodied energy, recycling	* 16.7	-	18.5	MJ/kg
CO2 footprint, recycling	* 0.605	-	0.669	kg/kg
Recycle fraction in current supply	1.43	-	1.58	%

Downcycle	✔			
Combust for energy recovery	✔			
Heat of combustion (net)	* 12.9	-	13.5	MJ/kg
Combustion CO2	* 1.08	-	1.13	kg/kg
Landfill	✔			
Biodegrade	✘			

Links

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Reference
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