

PMA poly(methyl acrylate)

PARAMETER	UNIT	VALUE	REFERENCES
GENERAL			
Common name	-	poly(methyl acrylate)	
IUPAC name	-	poly(methyl propenoate)	
CAS name	-	2-propenoic acid, methyl ester, homopolymer	
Acronym	-	PMA	
CAS number	-	9003-21-8	
Formula		$\left[\text{CH}_2\text{CH} \begin{array}{l} \\ \text{O}=\text{COCH}_3 \end{array} \right]_n$	
HISTORY			
Person to discover	-	Neher, H T	Neher, H T, US Patent 2,032,663, Roehm and Haas, Mar. 3, 1936.
Date	-	1936	
Details	-	laminated glass obtained with <i>in situ</i> polymerization of PMA	
SYNTHESIS			
Monomer(s) structure	-	$\text{H}_2\text{C}=\overset{\text{O}}{\parallel}{\text{C}}\text{COCH}_3$	
Monomer(s) CAS number(s)	-	96-33-3	
Monomer(s) molecular weight(s)	dalton, g/mol, amu	86.04	
Monomer ratio	-	100%	
Method of synthesis	-	because of high heat of polymerization, the best conditions of temperature control are given in emulsion polymerization; catalyst of polymerization is dissolved in water	
Time of polymerization	min	20-25	
Pressure of polymerization	Pa	atmospheric	
Catalyst	-	ammonium peroxydisulfate or potassium peroxydisulfate	
Mass average molecular weight, M_w	dalton, g/mol, amu	38,000-555,000	
Polydispersity, M_w/M_n	-	1.15-1.26	
Molar volume at 298K	cm ³ mol ⁻¹	calc.=70.6 (amorphous)	
Van der Waals volume	cm ³ mol ⁻¹	calc.=45.9 (amorphous)	
Degree of branching	%	1.92	Castignolles, P; Graf, R; Parkinson, M; Wilhelm, M; Gaborieau, M, Polymer, 50, 2373-83, 2009.
STRUCTURE			
Entanglement molecular weight	dalton, g/mol, amu	calc.=9070	
PHYSICAL PROPERTIES			
Density at 20°C	g cm ⁻³	1.19-1.22	
Refractive index, 20°C	-	1.4793	

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Decomposition temperature	°C	227	Castignolles, P; Graf, R; Parkinson, M; Wilhelm, M; Gaborieau, M, Polymer, 50, 2373-83, 2009.
Glass transition temperature	°C	calc.=6-9; exp.=3.5-21; 17.8-19.9 (absorbed on treated silica); 23.2-24.3 and 40.4-42.3 and 60.7 (absorbed on untreated silica)	Castignolles, P; Graf, R; Parkinson, M; Wilhelm, M; Gaborieau, M, Polymer, 50, 2373-83, 2009; Metin, B; Blum, F D, Langmuir, 26, 7, 5226-31, 2010.
Hildebrand solubility parameter	MPa ^{0.5}	calc.=18.21; exp.=20.7	
Surface tension	mN m ⁻¹	41.0-42.7	
Surface free energy	mJ m ⁻²	39.8	
CHEMICAL RESISTANCE			
Alcohols	-	good	
Aliphatic hydrocarbons	-	good	
Aromatic hydrocarbons	-	poor	
Esters	-	poor	
Halogenated hydrocarbons	-	poor	
Ketones	-	poor	
Good solvent	-	aromatic hydrocarbons, chlorinated hydrocarbons, esters, glycolic ester ethers, THF	
Non-solvent	-	alcohols, aliphatic hydrocarbons, carbon tetrachloride, diethyl ether	
FLAMMABILITY			
Ignition temperature	°C	>250	
Autoignition temperature	°C	304	
Volatile products of combustion	-	CO, CO ₂ , methyl formate, formaldehyde, methanol	
WEATHER STABILITY			
Products of degradation	-	formaldehyde, methanol, and methyl formate	
TOXICITY			
Carcinogenic effect	-	not listed by ACGIH, NIOSH, NTP	
BLENDS			
Suitable polymers	-	PEO, PLA, PMMA, PS, PVF	
ANALYSIS			
NMR (chemical shifts)	ppm	H NMR: CH ₃ – 2.1-14 triplet; methine – 2.3; C NMR: C=O – 174.6-175	Brar, A S; Goyal, A K; Hooda, S, J. Molecular Structure, 885, 15-17, 2008.