



ACRYLONITRILE-BUTADIENE-STYRENE (RAU-ABS)

MATERIAL DATA SHEET AV0270 EN

Chemical structure

ABS plastics are thermoplastics that – by reason of their chemical composition – belong to the group of polystyrenes with high impact strength. The monomeric constituents are acrylonitrile, butadiene and styrene. Combining these monomers together in different combinations by means of copolymerization or graft polymerization enables a wide range of ABS types to be produced which can differ from one another widely in terms of their palette of properties.

Characteristic properties

ABS possesses in general superior dimensional stability under heat, aging resistance, mechanical strength, chemical resistance and surface gloss than impact resistance polystyrene. A property of certain ABS types worthy of particular mention is that of the good adhesion of galvanically applied metallic coatings that can be achieved.

Thermal properties

(see also Table 1)

Most of the ABS types can be subjected to temperatures of 80–85 °C provided that they are not at the same time subjected to mechanical stress. Certain types with higher thermal resistance can even withstand temperatures up to 105 °C without deformation in so far as no forces are acting on the molding. The toughness falls only gradually with decreasing temperature down to about –30 °C. With certain types the good impact strength is retained down to as low as –30 °C.

Mechanical properties

(see also Table 2)

ABS plastics are characterized by high toughness, notch impact strength, shock resistance, flexural strength and surface hardness. It is particularly in this group of properties that the ability to vary the properties by altering the proportions of the monomeric constituents can be used to advantage.

Electrical properties

(see also Table 3)

ABS plastics are good electrical insulators and possess high surface resistance and volume resistivity. However, the electrostatic behavior of certain ABS types can be improved with the aid of additives to such an extent that molded parts only become charged to a very low degree. These types can be designated antistatic to a great extent. In practice this means that such parts will not even show the dust-holding effects often characteristic of plastics.

Chemical resistance

At room temperature ABS plastics are characterized by good chemical resistance to concentrated and diluted alkalis, to diluted organic acids and diluted hydrochloric, nitric and sulphuric acid, to aliphatic hydrocarbons (gasoline) and to many aqueous salt solutions. Mineral, animal and vegetable oils do not attack ABS. On the other hand, however, ABS is attacked, caused to swell up and in part dissolved by low molecular aromatic substances, ketones, ethers, esters, chlorohydrocarbons and carbon disulfide. Concentrated mineral acids, e.g. concentrated hydrochloric and sulphuric acid, fuming nitric acid and concentrated organic acids also act in a destructive manner.

Weathering and aging resistance

The ABS types are effectively stabilized against aging resulting from atmospheric oxygen and elevated temperatures. Similarly they are extremely resistant to even extreme fluctuations in temperature and relative humidity. However ABS contains a proportion of rubber and this component is gradually embrittled by extended exposure to direct solar radiation. Visible yellowing – this being particularly apparent with white and pastel shades – also occurs at the same time as the above-mentioned embrittlement. This is caused primarily by the UV radiation components in sunlight. Dark, especially black colors are fundamentally more resistant to the effects of light and can be designated as having good light resistance.

Combustibility

ABS burns with a bright, very sooty flame. ABS is classified in accordance with ASTM D 635-63 as being “a material that burns slowly”. For special areas of application, self-extinguishing ABS types are available and can be used.

Permeability to gas

The permeability to water vapor is greater than that of the other polystyrenes, the general gas permeability lower.

Physiological properties

ost ABS types meet the EC directive 2002/72/EC; the German Consumer Goods Act and, respectively, the BfR (formerly BgVV or BGA) recommendation VI „Styrene mix and graft polymerizates and mixes of polystyrene with polymerisates“, edition 01.01.02 (20th information: Federal German Health Bulletin 45, 463 (2002).

Coloring

RAU-ABS can be supplied in all the standard and special colors approved by the raw material manufacturer.

Bonding

ABS components can be bonded together with the aid of a solvent, preferably methylisobutylketone. The best results are obtained when approx. 5 % ABS is dissolved in the solvent. Bi-component adhesives are best for the bonding of ABS to other materials and/or the bond should be able to withstand high loadings. In special cases please contact our application engineering department. ABS plastics can be processed by cutting processes in a problemfree manner. They can be drilled, milled, sawn, lathed, planed and nailed.

Welding

ABS can be bonded well by ultrasonic welding. In addition ABS can be welded with hot air or nitrogen at 220–230 °C with an ABS wire. Naturally the other methods such as friction welding, welding with heat reflectors and – provided account is taken of different wall thickness – heat pulse methods can also be employed.

Application

RAU-ABS can be processed by all processes commonly used for thermoplastic materials. RAU-ABS is extruded for the production of sections, pipes and plates. RAU-ABS is suitable for products of every type by reason of its mechanical strength which is superior to even that of impact resistant polystyrene. A multitude of parts are produced by injection molding for the areas of motor vehicles, furniture and hi-fi/television. We are furthermore in a position to produce RAU-ABS by blow molding and the Tufnik process. RAU-ABS is used above all in the kitchen, automobile, electro and furniture industries. In addition metallic coatings can be applied to the surface of ABS moldings. ABS is frequently to be found in this form in particular in the automobile and sanitary fittings industries.

Table 1: Thermal properties of RAU-ABS

Thermal conductivity		kcal/m/h/°C	0.14–0.18
Linear coefficient of thermal expansion (+20°C to +80°C)	ISO 11359-2	1/°C	$8-9 \times 10^{-5}$
Vicat softening temperature	ISO 306	°C	90–120
Maximum service temperature		°C	80–100
Cold crack temperature		°C	–40

Table 2: Mechanical properties of RAU-ABS

Density	ISO 1183-1/A	g/cm ³	1.06–1.15
Water absorption	ISO 62	%	0.2–0.3
Tensile strength	ISO 527-1	MPa	40–50
Elongation at break	ISO 527-1	%	> 5
Flexural modulus of tension	ISO 527-1	MPa	2400
Charpy impact strength, notched at +23 °C	ISO 179/1eA	kJ/m ²	15–25
Ball indentation hardness	ISO 2039-1	MPa	700–900

Table 3: Electrical properties of RAU-ABS

Volume resistivity	DIN IEC 60093	$\Omega \times m$	10^{14}
Dielectric constant	IEC 60250	10^3 Hz	4.6
Dielectric loss factor, tangential	IEC 60250	10^3 Hz	3.6×10^{-2}
Dielectric strength of insulating materials	DIN EN 60243	kV/mm	33
Surface resistance	DIN IEC 60093	Ω	8×10^{11}

Chemical Resistance of RAU-ABS Series

Medium, Concentration	Temperature (°C)	
	20	50
Acetamide	+	+
Acetate of alumina (sol.)	+	+
Acetic acid (100 %)	-	-
Acetic acid (25 %)	+	+
Acetic acid (50 %)	+	0
Acetic acid amyl ester	-	-
Acetic acid benzyl ester	-	-
Acetic acid butyl ester	-	-
Acetic acid ethyl ester	-	-
Acetic acid isopropyl ester	-	-
Acetic acid methyl ester	-	-
Acetone	-	-
Acetophenone	-	-
Acetylsalicylic acid (sol.)	+	+
Allyl alcohol	-	-
Allyl mustard oil	-	-
Almond oil	+	+
Aluminium chloride (sol.)	+	+
Aluminium sulphate (sol.)	+	+
Alums (sol.)	+	+
Ammonia, aqueous (25 %)	+	+
Ammonium carbonate (sol.)	+	+
Ammonium chloride (sol.)	+	+
Ammonium molybdate (sol.)	+	+
Ammonium nitrate (sol.)	+	+
Ammonium sulphate (sol.)	+	+
Ammonium thiocyanate (sol.)	+	+
Amyl acetate	-	-
Amyl alcohol	+	0
Amyl cinnamic acid aldehyde	-	-
Amyl mercaptan	-	-
Aniline	-	-
Anise	+	+
Anise oil	-	-
Apple juice	+	+
Apple wine	+	
Aqua regia	0	-
ATE brake fluid	-	-
Atropine sulphate	+	+
Barium bromide (sol.)	+	+
Barium carbonate (sol.)	+	+
Barium chloride (sol.)	+	+
Beef tallow	+	+
Benzaldehyde	-	-
Benzene	-	-
Benzoic acid	+	+
Benzoic acid ethyl ester	-	-
Benzyl alcohol	-	-
Bismuth chloride (sol.)	+	+
Bismuth nitrate basic (sol.)	+	+
Bitter almond oil	+	0
Bone oil	+	+
Borax (sol.)	+	+
Boric acid (sol.)	+	+

Medium, Concentration	Temperature (°C)	
	20	50
Brandy	+	
Bromine (liquid)	-	-
Butane	+	
Butter	+	+
Butyl acetate	-	-
n-butyl alcohol	+	0
Butyric acid	-	-
Cadmium bromide (sol.)	+	+
Caesium bromide (sol.)	+	+
Caffeine (sol.)	+	+
Calcium bromide (sol.)	+	+
Calcium chloride (sol.)	+	+
Calcium hypochlorite (sol.)	+	+
Calcium hypochlorite (solid)	+	+
Calcium oxide	+	+
Camomile extract	+	
Camphor	+	+
Caraway (ground)	+	+
Carbazole	+	+
Carbon dioxide	+	+
Carbon disulphide	-	-
Carbon tetrachloride	-	-
Cardamom	+	+
Carnauba wax	+	+
Carrot juice	+	
Castor oil	+	+
Cellosolve (methyl, ethyl, propyl, butyl)	-	-
Cetyl alcohol	+	+
Chlorinated lime	+	+
Chlorine (liquid or gas)	-	-
Chlorine bleach solution (12 % Cl)	+	+
Chlorine water	0	
Chloroacetic acid	0	-
Chlorobenzene	-	-
Chloroform	-	-
Chlorosulphonic acid	-	-
Chromic acid (sol.)	0	0
Chromosulphuric acid	0	0
Cinnamic aldehyde	-	-
Cinnamon (ground)	+	+
Cinnamon (sticks)	+	+
Citric acid (sol.)	+	+
Citronella oil	-	-
Clove oil	-	-
Cloves	-	-
Cloves see "cloves"		
Cocoa butter	+	+
Coconut oil	+	+
Cod liver oil	+	+
Coffee (ground)	+	+
Coffee extract	+	+
Copper sulphate (sol.)	+	+
Cottonseed oil	+	+
p-cresol	0	-

Medium, Concentration	Temperature (°C)	
	20	50
Cup grease	+	+
Curry	+	+
Cyclohexane	+	0
Cyclohexanol	+	0
Cyclohexanone	-	-
Decalin (R)	0	0
Dehydro acetic acid	+	+
Diacetone alcohol	-	-
Dichlorobenzene	-	-
Diesel oil	+	+
Diethanolamine	+	+
Diethyl ether	-	-
Diethyl ketone	+	+
Diethylene glycol	+	+
Dimethylformamide	-	-
1.4 dioxane	-	-
Diphenyl ether	-	-
Diphenylamine	-	-
Disodium hydrogen phosphate	+	+
Engine oils (motor vehicle)	+	+
Ethanol (40 %)	+	0
Ethanol (95 %)	+	0
Ether (diethyl ether)	-	-
Ethyl chloride	-	-
Ethylbenzene	-	-
Ethylene chloride	-	-
Ethylene glycol	+	+
Eucalyptus oil	0	0
Ferric ammonium sulphate	+	+
Fertiliser salts	+	+
Fluoric acid (40 %)	0	0
Formaldehyde (30 %)	+	0
Formic acid (40 %)	+	0
Formic acid (85 %)	0	0
Furfural	-	-
Furfuryl alcohol	0	-
Gallic acid	+	+
Garlic (powder)	+	+
Ginger (ground)	0	0
Glucose (30 %)	+	+
Glycerine	+	+
Grapefruit juice	+	+
Gravy	+	+
Heating oil	+	+
Heptane	0	
Heptyl alcohol	+	0
Hexachlorobenzene	+	+
Hexane	0	
Hexanetriol	+	+
Hexanol	+	0
Honey	+	+
Horseradish	+	
Hydrochloric acid (15 %)	+	0
Hydrochloric acid (conc.)	+	0

Medium, Concentration	Temperature (°C)	
	20	50
Hydrogen peroxide (3 %)	+	+
Hydrogen peroxide (30 %)	+	
Hydrogen sulphide	+	
Hydroquinone (sol.)	+	0
Hydroxyacetone	0	
Ink	+	+
Iodine tincture	0	
Iron II chloride (sol.)	+	+
Iron II chloride (solid)	+	+
Iron II sulphate (solid)	+	+
Iron III chloride (sol.)	+	+
Iron nitrate (sol.)	+	+
Isoamyl alcohol	+	0
Isobutyl alcohol	0	-
Isooctane	+	+
Isopropanol	0	-
Jam	+	+
Lactic acid (10 %)	+	+
Lactic acid (80 %)	+	+
Lactose (sol.)	+	+
Lanolin	+	+
Laurel (ground)	+	+
Lauryl alcohol	+	+
Lead acetate (sol.)	+	+
Lead nitrate (sol.)	+	+
Lead stearate	+	+
Lead sulphate (sol.)	+	+
Lemon juice	+	+
Lemon zest oil	0	0
Lemongrass oil	-	-
Ligroin	+	+
Limewater	+	+
Linseed oil	+	+
Liquorice powder	+	+
Mace (ground)	+	0
Magnesium bromide	+	+
Magnesium carbonate	+	+
Magnesium chloride (sol.)	+	+
Magnesium sulphate (sol.)	+	+
Maize oil	+	+
Malic acid (10 %)	+	+
Mandarin zest oil	0	0
Margarine	+	+
Marjoram (ground)	+	+
Mayonnaise	+	
Menthol (10 % in alcohol)	0	0
Mercuric chloride (sol.)	+	+
Mercury	+	
Mesityl oxide	-	-
Methanol	0	-
Methyl chloride	-	-
Methyl ethyl ketone	-	-
Methyl isobutyl ketone	-	-
Methyl isopropyl ketone	-	-

Medium, Concentration	Temperature (°C)	
	20	50
Methyl propyl ketone	–	–
Methylbutyl alcohol	+	0
Methylcyclohexane	+	+
Methylene chloride	–	–
Methylene chlorobromide	–	–
Milk	+	+
Milk powder (damp)	+	+
Milk powder	+	+
Milk products	+	+
Milk sugar see "lactose"		
Mountain pine oil	0	–
Mustard	+	+
Naphthalene (sol. in alcohol)	0	–
Naphthalene (solid)	+	–
Naphthol (beta) (sol. in alcohol)	0	–
Nickel sulphate (sol.)	+	+
Nitric acid (30 %)	+	0
Nitric acid (conc.)	–	–
Nitrobenzene	–	–
n-nonyl alcohol	+	+
Nutmeg dark (ground)	0	0
Nutmeg light (ground)	+	0
Nutmeg oil	0	–
i-octane	+	+
n-octyl alcohol	+	+
Oleic acid	+	0
Olive oil	+	+
Onion (powder)	+	+
Orange juice	+	+
Orange zest oil	0	0
Oxalic acid (sol.)	+	+
Oxymethyl furfural	–	–
Ozone (<0.5 ppm)	+	+
Palamoll 644 and 646 (polyester based on adipic acid, BASF)	–	–
Palm oil	+	+
Palmitic acid	+	+
Paprika (ground)	+	+
Paraffin oil	+	+
Peanut oil	+	+
Pectin (sol.)	+	+
Penicillin	+	+
Pentane	0	0
Pepper (black or white, ground)	+	0
Peppermint oil	–	–
Perchloroethylene (tetrachloroethylene)	0	0
Petrol (normal unleaded)	0	–
Petrol (super unleaded)	0	–
Petroleum ether	0	0
Petroleum	0	–
Phenacetin	+	+
Phenol	–	–
Phenylethyl alcohol	–	–
Phosphoric acid (1 %)	+	+
Phosphoric acid (30 %)	+	+
Phosphoric acid (85 %)	+	+

Medium, Concentration	Temperature (°C)	
	20	50
Phthalic acid (sol.)	+	+
Phthalic acid dibutyl ester	–	–
Phthalic acid diethyl ester	–	–
Phthalic acid diethylhexyl ester	+	0
Phthalic acid diisodecyl ester	0	0
Phthalic acid dimethyl ester	–	–
Phthalic acid dimethyldiglycol ester	0	0
Phthalic acid dinonyl ester	0	0
Phthalic acid monoamyl ester	–	–
Pimento (ground)	0	0
Pineapple juice	+	+
Plastomoll DOA (adipic acid di(2-ethylhexyl) ester), BASF	0	0
Pork dripping	+	+
Potassium aluminium sulphate (sol.)	+	+
Potassium bichromate (sol.)	+	0
Potassium bisulphate	+	+
Potassium bromate (sol.)	+	+
Potassium bromide (sol.)	+	+
Potassium chloride (sol.)	+	+
Potassium chromate (sol.)	+	+
Potassium fluoride (sol.)	+	+
Potassium hydroxide (10 %)	+	0
Potassium hydroxide (50 %)	+	0
Potassium hydroxide (conc. sol.)	+	–
Potassium iodate (sol.)	+	+
Potassium iodide (sol.)	+	+
Potassium iron III cyanide	+	+
Potassium nitrate (sol.)	+	+
Potassium permanganate (sol.)	+	0
Potassium persulphate (sol.)	+	+
Potassium sulphate (sol.)	+	+
Potassium sulphide (sol.)	+	+
Prontosil	+	
Propane (liquid)	+	
i-Propanol	+	–
n-Propanol	+	0
Propylene chloride	–	–
Propylene glycol	+	+
Propylene glycol methyl ether	–	–
Propylene oxide	–	–
Pyridine	–	–
Pyrogallol (sol.)	+	0
Refrigerants/Freon 11 (monofluorotrichloromethane)	0	0
Refrigerants/Freon 113 (trifluorotrichloroethane)	0	0
Refrigerants/Freon 114 (tetrafluorodichloroethane)	0	0
Refrigerants/Freon 12 (difluorodichloromethane)	0	0
Refrigerants/Freon 21 (monofluorodichloromethane)	–	–
Refrigerants/Freon 22 (difluoromonochloromethane)	–	–
Resorcin (sol.)	0	0
Rongalite (sol.)	+	+
Rose oil	0	
Rum	+	
Rum flavouring	+	
Salicylic acid (sol.)	+	+
Salicylic acid methyl ester	–	–
Salt (dry)	+	+

Medium, Concentration	Temperature (°C)	
	20	50
Sandalwood oil	–	–
Sassafras oil	–	–
Sausage grease	+	
Seawater	+	+
Seawater see "seawater"		
Sebacic acid dibutyl ester	–	–
Silicone oil	+	+
Silver nitrate (sol.)	+	+
Sodium acetate (sol.)	+	+
Sodium benzoate (sol.)	+	+
Sodium bicarbonate (sol.)	+	+
Sodium bisulphite (sol.)	+	+
Sodium borate (sol.)	+	+
Sodium bromate (sol.)	+	+
Sodium bromide (sol.)	+	+
Sodium carbonate (sol.)	+	+
Sodium chloride (dry)	+	+
Sodium chloride (sol.)	+	+
Sodium chromate (sol.)	+	+
Sodium fluoride (sol.)	+	+
Sodium hydrogen sulphite	+	+
Sodium hydroxide (50 %)	+	+
Sodium hypochlorite (sol., 12 % chlorine)	+	+
Sodium nitrate	+	+
Sodium nitrite	+	+
Sodium perborate (sol.)	+	+
Sodium phosphate (tert.) (sol.)	+	+
Sodium sulphate (sol.)	+	+
Sodium sulphide (sol.)	+	+
Sodium sulphite (sol.)	+	+
Sodium thiosulphate (sol.)	+	+
Soya oil	+	+
Sperm oil	+	
Spruce needle oil	0	–
Stearic acid	+	+
Strontium bromide	+	+
Strychnine	+	+
Sugar solution (30 %)	+	+
Sulphur	+	+
Sulphur hexafluoride	+	
Sulphuric acid (10 %)	+	+
Sulphuric acid (38 %, battery acid)	+	+
Sulphuric acid (50 %)	+	+
Sulphuric acid (conc.)	–	–
Table vinegar	+	+
Tannic acid	+	+
Tartaric acid (sol.)	+	+
Tea leaves (damp)	+	+
Tea powder	+	+
Terpentine	0	0
Terpentine substitute	+	0
Tetrachloroethane	–	–
Tetrahydrofuran	–	–
Tetrahydrofurfuryl alcohol	–	–
Tetralin	–	–
Thionyl chloride	–	–

Medium, Concentration	Temperature (°C)	
	20	50
Thiophene	–	–
Thymol	–	–
Tin II chloride (sol.)	+	+
Tin IV chloride (sol.)	–	–
Titanium tetrachloride	–	–
Toluene	–	–
Tomato juice	+	+
Tragacanth	+	+
Transformer oil	+	0
Trichlorobenzene	–	–
Trichloroethane	–	–
Trichloroethylene	–	–
Trichlorophenol	–	–
Tricresyl phosphate	–	–
Triethanolamine	+	+
Triethylene glycol	+	+
Triglycol acetate	–	–
Trypaflavine (R)	+	
Tryptophan (d or l)	+	+
Turkey red oil	+	+
Tyrosine (d or l)	+	+
Undecyl alcohol	+	+
Urea (sol.)	+	+
Urotropine (sol.)	+	+
Valerian drops	+	
Vaseline	+	+
Verbena oil	–	
Washing detergent	+	
Water	+	+
Water glass	+	+
Watercolours	+	+
Wax (bleached)	+	+
Whisky	+	
White oil	+	+
White spirit	+	0
Wintergreen oil	–	–
Xylene	–	–
Zinc bromide	+	+
Zinc carbonate	+	+
Zinc chloride (sol.)	+	+
Zinc nitrate	+	+
Zinc ointment	+	+
Zinc oxide	+	+
Zinc stearate	+	+
Zinc sulphate (sol.)	+	+

ABS

+: Resistant – only slight weight, dimensional and property change

0: Partially resistant – marked change irreversible after a long period
(e.g. embrittling, formation of stress cracks)

–: Non-resistant – immediate strong attack, dissolving or formation of stress cracks, irreversible damage

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