



*E*astar

Copolyester 6763

EASTMAN

Contents

Introduction	2
Properties	3
Optical Properties	3
Thermal and Rheological Properties	3
Burning Characteristics	3
Chemical Resistance	7
Barrier Properties	7
Weatherability	8
Color	8
Quality Manufacturing	8
<i>Eastar</i> Copolyester 6763 in the PET Recycle Stream	8

Tables

Table 1—Physical Properties of Film Extruded in Eastman’s Laboratories From <i>Eastar</i> Copolyester 6763	4
Table 2—Thermal Properties of <i>Eastar</i> Copolyester 6763	6
Table 3—Electrical Properties of <i>Eastar</i> Copolyester 6763	7
Table 4—Rheological Properties of <i>Eastar</i> Copolyester 6763 Using a Capillary Rheometer and Constant Shear Rate Method	11

Figures (Rheological Properties of *Eastar* Copolyester 6763)

Figure 1—Viscosity vs. Temperature	9
Figure 2—Viscosity vs. Shear Rate	9
Figure 3—Viscosity vs. Shear Stress	10
Figure 4—Shear Stress vs. Shear Rate	10

Introduction

Eastar copolyester 6763 is useful in a variety of processes and applications because of its clarity, toughness, and good melt strength at processing temperatures. These include:

■ Film and Sheet Extrusion

Applications — Sheet for protective covers and displays.
Thermoformed containers for rigid medical packaging, refrigerated/frozen foods, candies, and sundries.

Features — Gloss, transparency, toughness, fast-forming cycles, ease of forming, reusable scrap, radio frequency sealable, and resistance to stress whitening.

■ Extrusion Blow Molding

Applications — Bottles for packaging shampoos, soaps, detergents, and oils.

Features — Clarity, barrier properties, chemical resistance, toughness, and processability.

■ Shape and Tubing Extrusion

Applications — Packaging, protective sleeves, and various profiles.

Features — Clarity, toughness, and cost savings.

Eastar copolyester 6763 is a clear amorphous polymer with a glass transition temperature (T_g) of approximately 80°C (176°F) as determined by Differential Scanning Calorimetry. It is based on poly(ethylene terephthalate) and has a number-average molecular weight (M_n) of about 26,000. The copolyester 6763 pellets have a poured bulk density (by ASTM D1895) of about 45 lb/ft³ (721 kg/m³) and a vibrated bulk density of about 50 lb/ft³ (801 kg/m³).

As is the case with all thermoplastic polyesters, 6763 is subject to hydrolysis when it is in the molten state during processing. This hydrolysis results in a decrease in molecular weight that is reflected by a lowering of physical properties, especially toughness. To prevent a harmful degree of hydrolysis during processing, 6763 should be thoroughly dried. Drying the material in a dehumidifying dryer at a temperature of 65°C (~150°F) for 6 hours is normally sufficient to reduce the moisture content to less than 0.04% and to prevent significant hydrolysis in processing equipment operating at 195° to 275°C (380° to 525°F).

Optical Properties

Items produced from *Eastar* copolyester 6763 by blow molding or extrusion can have good transparency, low haze, and high gloss. Optical properties of 250-micron (10-mil) film extruded from 6763 are given in Table 1 along with other film properties.

Thermal and Rheological Properties

Since *Eastar* copolyester 6763 is amorphous, its thermal properties are essentially determined by its glass transition temperature of approximately 80°C (176°F). This copolyester has deflection temperatures of 64°C (147°F) at a fiber stress of 1.82 MPa (264 psi) and 70°C (158°F) at 0.455 MPa (66 psi). Deflection temperatures and other thermal properties are given in Table 2.

Drying temperatures must be no higher than 65°C (~150°F) to prevent pellets from sticking together in the dryer. At relatively low processing temperatures of 195° to 220°C (380° to 425°F), *Eastar* copolyester 6763 has a desirable combination of melt viscosity/melt strength, enabling the material to be used in parison extrusion for blow molding. At temperatures encountered in injection molding [250° to 270°C (480° to 520°F)], the viscosity of 6763 decreases with increase in temperature and shear rate. The effects that temperature, shear rate, and shear stress have on the viscosity of 6763 are shown in Figures 1, 2, and 3. Shear stress versus shear rate is given in Figure 4. The rheological properties of 6763 are summarized in Table 4.

Burning Characteristics

Eastar copolyester 6763 has been tested by Underwriter's Laboratories (Test Method UL 94) and classified as follows:

Thickness	Rating
1.14 mm (0.0449 in.)	94HB

Table 1

Physical Properties of Film Extruded in Eastman's Laboratories
From *Eastar* Copolyester 6763

Property, ^a Units	Typical Value	Test Method	
		ASTM	ISO
Inherent Viscosity	0.70	— ^b	— ^b
Thickness of Film Tested			
Microns	250	D374	—
Mils	10		
Density, g/cm ³	1.27	D1505	1183, Method D
Haze, %	0.8	D1003	—
Gloss @ 45°	108	D2457	—
Transparency, %	85	D1746	—
Transmittance, %			
Regular (Specular)	89	D1003 Modified	—
Total	91		
Water Vapor Transmission Rate ^c			
g/m ² ·24h	6	F372	—
g/100 in. ² ·24h	0.4		
Gas Permeability			
cm ³ ·mm/m ² ·24h·atm (cm ³ ·mil/100 in. ² ·24h·atm)			—
CO ₂	49 (125)	D1434	
O ₂	10 (25)	D3985	
Elmendorf Tear Resistance, N (gf)			
M.D.	13.7 (1,400)	D1922	6383/2
T.D.	16.7 (1,700)		
PPT Tear Resistance, N (lbf)			
M.D.	93 (21)	D2582	—
T.D.	93 (21)		
Tear Propagation Resistance			
Split-Tear Method @ 254 mm/min (10 in./min)			
M.D., N (lbf)	9.1 (2.1)	D1938	—
N/mm (lbf/in.)	36 (205)		
T.D., N (lbf)	9.1 (2.1)		
N/mm (lbf/in.)	36 (205)		

(continued on next page)

Table 1 (Continued)

Property, ^a Units	Typical Value	Test Method	
		ASTM	ISO
Tear Resistance, Trouser @ 200 mm/min speed, N/mm (lbf/in.)			
M.D.	36 (205)	—	6383/1
T.D.	36 (205)		
Tensile Strength @ Yield, MPa (psi)			
M.D.	52 (7,500)		
T.D.	52 (7,500)		
Tensile Strength @ Break, MPa (psi)			
M.D.	59 (8,600)		
T.D.	55 (8,000)		
Elongation @ Yield, %		D882	527-3/2/50
M.D.	4		
T.D.	4		
Elongation @ Break, %			
M.D.	400		
T.D.	400		
Tensile Modulus, MPa (10 ⁵ psi)			
M.D.	1,900 (2.8)	D882	527-3/2/25, 254-mm gauge length
T.D.	1,900 (2.8)		
Dart Impact, 12.7 mm (½ in.) dia. head, 127 mm (5 in.) dia. clamp, 660 mm (26 in.) drop, g			
@ 23°C (73°F)	400	D1709A Method A modified	7765/A Method A modified
–18°C (0°F)	500		

^aUnless noted otherwise, all tests were run @ 23°C (73°F) and 50% relative humidity.

^bInherent viscosity was determined using test method ECC-A-AC-G-V-1.

^cTest conducted @ 38°C (100°F) and 100% relative humidity.

Some variation is inherent in all plastics testing, and the preceding data are considered to be representative of average properties for 250-micron (10-mil) film. Eastman makes no representation that the material in any particular shipment will conform exactly to the values given.

Table 2

Thermal Properties of *Eastar* Copolyester 6763

Property, ^a Units	Typical Value	Test Method	
		ASTM	ISO
Deflection Temperature			
@ 1.82 MPa (264 psi) fiber stress, °C	64		
°F	147	D648	75
@ 0.455 MPa (66 psi) fiber stress, °C	70		
°F	158		
Vicat Softening Point, °C			
°F	85	D1525	306
185			
Thermal Conductivity, W/m·K			
BTU·in./h·ft ² ·°F	0.21	C177	—
	1.5		
Glass Transition Temperature, °C			
°F	80	— ^b	— ^b
	176		
Specific Heat, kJ/kg·K (Btu/lb·°F)			
@ 60°C (140°F)	1.30 (0.31)		
100°C (212°F)	1.76 (0.42)	— ^b	— ^b
150°C (302°F)	1.88 (0.45)		
200°C (392°F)	1.97 (0.47)		
250°C (482°F)	2.05 (0.49)		
Coefficient of Linear Thermal Expansion, mm/mm·°C (–30° to +40°C)			
	5.1×10^{-5}	D696	—
Flammability [3.2-mm (1/8-in.) Thick Specimen]			
cm/min	<2.5	D635	—
in./min	<1		
UL Flammability Classification			
1.14 mm (0.0449 in.)	94HB	UL 94	—
Oxygen Index, %			
	24	D2863	—
Melt Density @ 200°C, g/cm ³			
250°C, g/cm ³	1.19	D1238	—
	0.98		

^aUnless noted otherwise, all tests were run @ 23°C (73°F) and 50% relative humidity.

^bGlass transition temperature and specific heat were determined by DSC.

Properties reported here are typical of average lots. Eastman makes no representation that the material in any particular shipment will conform exactly to the values given.

Table 3**Electrical Properties of *Eastar* Copolyester 6763**

Property,^a Units	Typical Value	Test Method
Dielectric Constant		
@ 1 kHz	2.6	
1 MHz	2.4	ASTM D150
Dissipation Factor		
@ 1 kHz	0.005	
1 MHz	0.02	
Arc Resistance, s	158	ASTM D495
Volume Resistivity, ohm·cm	10 ¹⁵	ASTM D257
Surface Resistivity, ohm/square	10 ¹⁶	ASTM D257
Dielectric Strength, Short Time		
@ 500 V/sec Rate-of-Rise, 3.2-mm (1/8-in.) Thick Test Specimen, kV/mm (V/mil)	16 (410)	ASTM D149

^aUnless noted otherwise, all tests were run @ 23°C (73°F) and 50% relative humidity.

Properties reported here are typical of average lots. Eastman makes no representation that the material in any particular shipment will conform exactly to the values given.

Chemical Resistance

Unstressed tensile bars molded of *Eastar* copolyester 6763 exhibit good resistance to dilute aqueous solutions of mineral acids, bases, salts, and soaps, and to aliphatic hydrocarbons, alcohols, and a variety of oils. Halogenated hydrocarbons, short chain length ketones, and aromatic hydrocarbons dissolve or swell the plastic.

The chemical resistance of *Eastar* copolyester 6763 is the subject of a separate Eastman publication, TR-145, that is available on request.

Barrier Properties

Water-vapor transmission rate and gas permeability measured on 250-micron (10-mil) film are given in Table 1.

Weatherability

Eastar copolyester 6763 does not contain a UV absorber, and it is not suggested for use in applications involving continuous long-term outdoor exposure.

Color

Eastar copolyester 6763 may be colored using color concentrates, dry colors, or liquid colorants.

To provide material compatibility, Eastman offers color concentrates compounded in an *Eastar* copolyester 6763 base. Most color concentrates are custom-made, but a few standard concentrates are available from stock. The mixing ratio for 6763 and color concentrate is usually 20:1.

Color concentrates should be dried in a manner similar to that suggested for 6763 to minimize hydrolytic degradation during processing.

Quality Manufacturing

Eastar copolyester 6763 is manufactured under a quality system that is registered by BSI, Certificate No. FM 14068, conforming to the requirements of ISO 9002, EN 290002, and BS 5750, Part 2.

Eastar Copolyester 6763 in the PET Recycle Stream

Studies by Eastman's laboratories indicate that blends of recycled PET containing small amounts of *Eastar* copolyester 6763 may be converted into products such as bottles and fibers that have altogether satisfactory properties.

When combining the two materials, it is suggested the *Eastar* copolyester be kept at a level of 3% or less by weight.

Figure 1
Viscosity vs. Temperature—*Eastar* Copolyester 6763

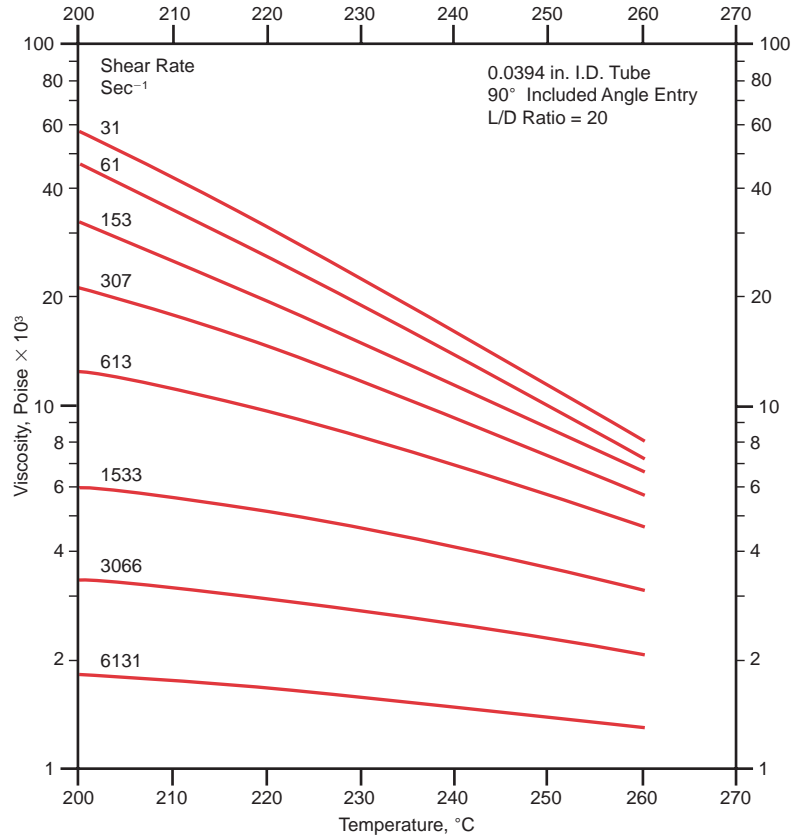


Figure 2
Viscosity vs. Shear Rate—*Eastar* Copolyester 6763

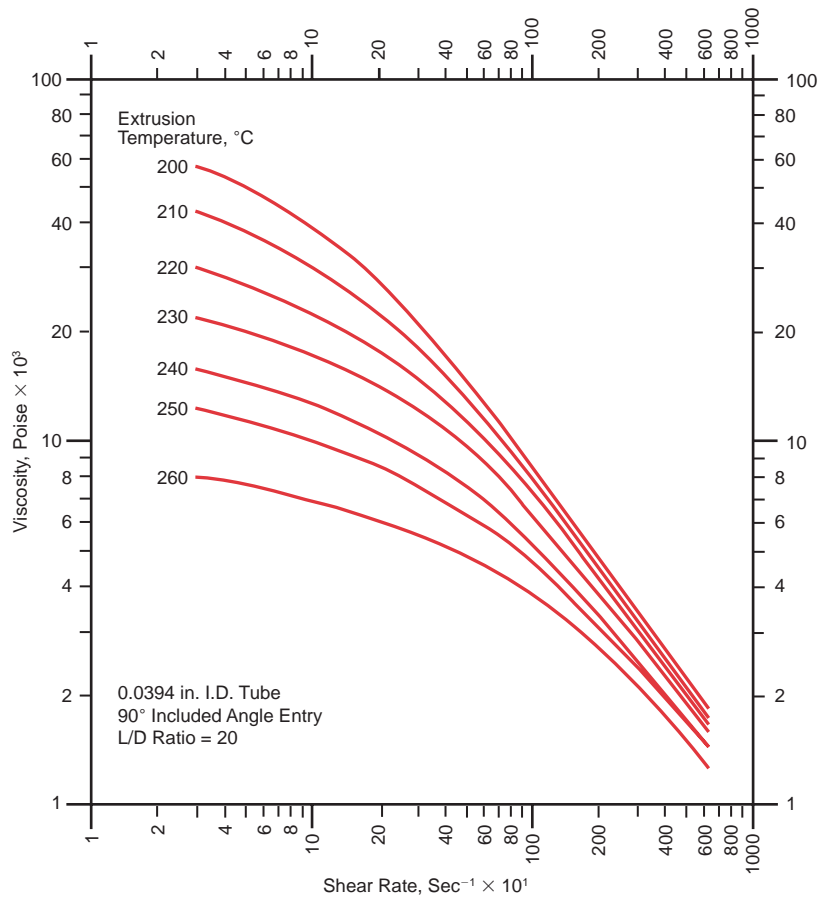


Figure 3

Viscosity vs. Shear Stress—*Eastar* Copolyester 6763

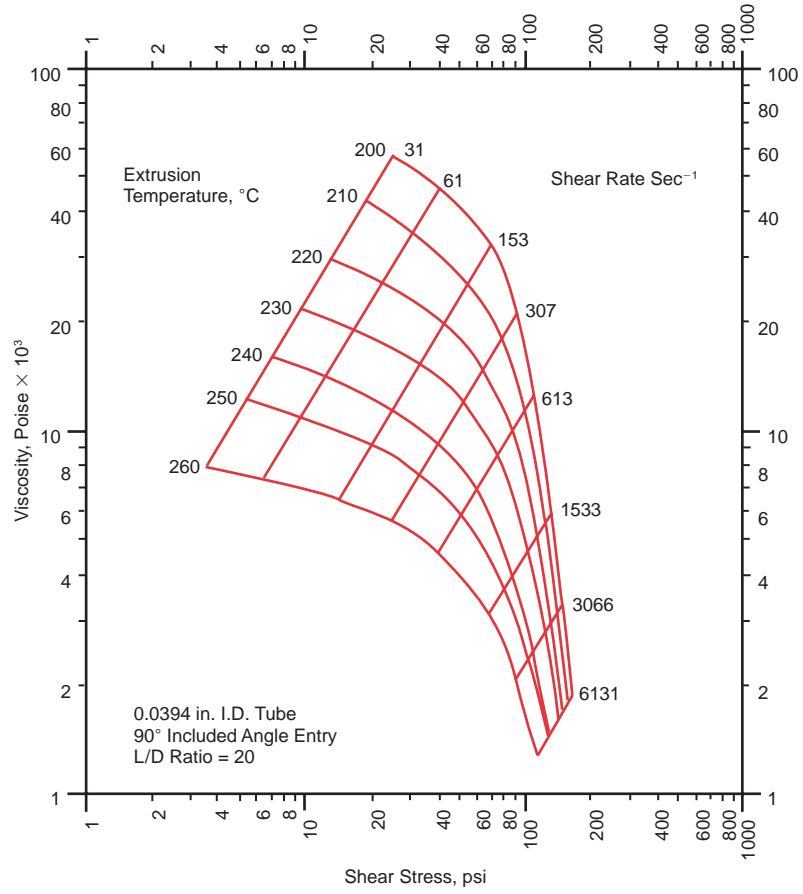


Figure 4

Shear Stress vs. Shear Rate—*Eastar* Copolyester 6763

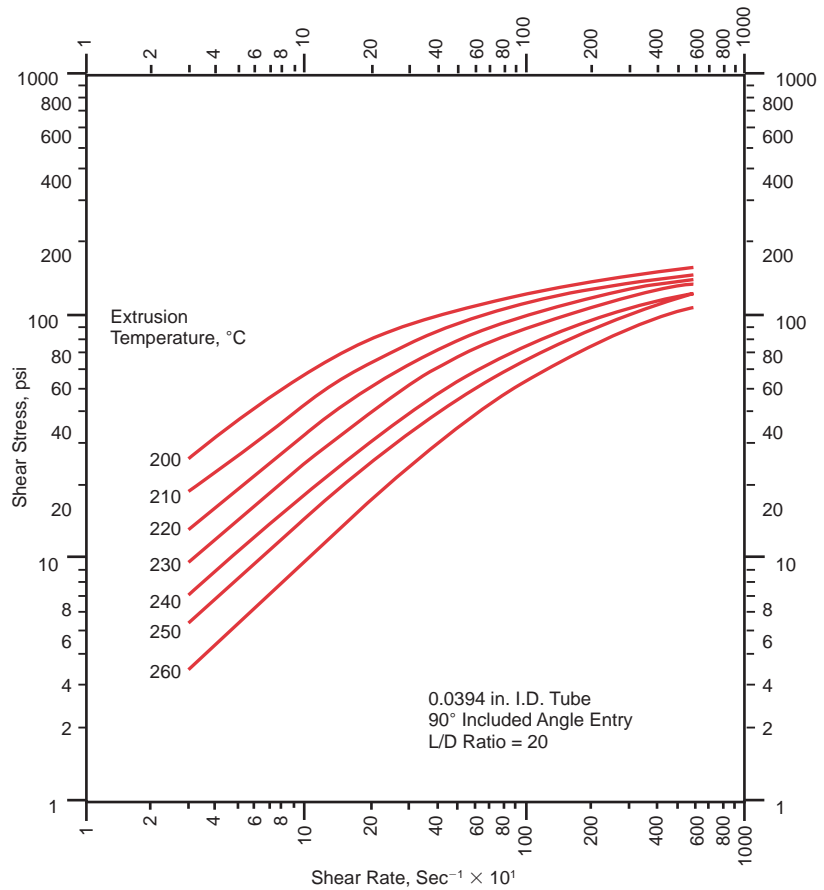


Table 4

**Rheological Properties of *Estar* Copolyester 6763
Using a Capillary Rheometer and Constant Shear Rate Method**

Capillary Diameter, 0.0394 in. (~1 mm)

Capillary Length, 0.7874 in. (~20 mm)

Temperature °C (°F)	Shear Stress psi	Shear Rate Sec ⁻¹	Apparent Viscosity	
			Poise	Pa·s
200 (392)	25.3	31	56,800	5,680
	41.3	61	46,500	4,650
	71.4	153	32,100	3,210
	92.9	307	20,900	2,090
	109.0	613	12,200	1,220
	133.0	1,530	5,960	596
	147.0	3,070	3,300	330
	161.0	6,130	1,810	181
210 (410)	19.0	31	42,800	4,280
	30.6	61	34,400	3,440
	56.5	153	25,400	2,540
	80.3	307	18,100	1,810
	99.7	613	11,200	1,120
	123.0	1,530	5,550	555
	139.0	3,070	3,130	313
	153.0	6,130	1,720	172
220 (428)	13.1	31	29,600	2,960
	22.7	61	25,500	2,550
	43.6	153	19,600	1,960
	65.7	307	14,800	1,480
	87.8	613	9,870	987
	116.0	1,530	5,200	520
	131.0	3,070	2,890	289
	147.0	6,130	1,660	166
230 (446)	9.6	31	21,700	2,170
	16.8	61	18,900	1,890
	34.0	153	15,300	1,530
	53.5	307	12,000	1,200

Table 4 (Continued)

Temperature °C (°F)	Shear Stress psi	Shear Rate Sec ⁻¹	Apparent Viscosity	
			Poise	Pa·s
230 (446)	75.9	613	8,530	853
	102.0	1,530	4,590	459
	125.0	3,070	2,800	280
	139.0	6,130	1,570	157
240 (464)	7.0	31	15,800	1,580
	12.5	61	14,000	1,400
	24.9	153	11,200	1,120
	40.8	307	9,170	917
	61.2	613	6,880	688
	87.8	1,530	3,950	395
	108.0	3,070	2,420	242
	129.0	6,130	1,450	145
250 (482)	5.4	31	12,200	1,220
	9.6	61	10,800	1,080
	20.3	153	9,120	912
	33.6	307	7,570	757
	51.9	613	5,830	583
	81.5	1,530	3,670	367
	103.0	3,070	2,320	232
	127.0	6,130	1,430	143
260 (500)	3.5	31	7,900	790
	6.5	61	7,260	726
	14.5	153	6,520	652
	24.9	307	5,600	560
	40.8	613	4,590	459
	69.7	1,530	3,130	313
	91.7	3,070	2,060	206
	113.0	6,130	1,270	127

Conversions of metric/U.S. customary values may have been rounded off and therefore may not be exact conversions.

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