

19 Polypropylene Data Collection

19.1 Data Sheet Properties

Material family	polypropylene homopolymer, polypropylene homopolymer, flame retardant, polypropylene homopolymer, fibers, polypropylene homopolymer, cast film, polypropylene, 10% talc, polypropylene, 20% talc, polypropylene, 20% talc, easy-flow						
Supplier	BASF, Vestolen GMBH, Vestolen GMBH, BASF, Hoechst, Hoechst, Hoechst						
Material Trade Name	Novolen 1100L, Vestolen P 7006 S, Vestolen P 4000, Novolen 1127 N, Hostacom M1 U01, Hostacom M2 N01, Hostacom M2 U01						
Source ID	756, CAMPUS, 711, CAMPUS, 711, CAMPUS, 756, CAMPUS, 326, CAMPUS, 326, CAMPUS, 326, CAMPUS						
Test Notes	Test condition	Test Specimen	Test Method	(Unit)			

PROCESSING PROPERTIES

melt volume rate (230°C, 2.16 kg)			ISO 1133, DIN 53735, CAMPUS	ml/10min	8	3	23	15	20	2.3	18
melt volume rate (190°C, 5 kg)			ISO 1133, CAMPUS	"	12			30	38	4.2	34
melt volume rate (230°C, 5 kg)		test specimen note: granules	DIN 53479	"					85	10	78
melt flow rate (230°C, 2.16 kg)			ISO 1133, DIN 53735	g/10min	5	2.4	17.5	11	16	2	16
melt flow rate (190°C, 5 kg)			"	"	9	4.5	33	22	28	3.8	28
melt flow rate (230°C, 5 kg)			"	"		11	80		67	9	67
molding shrinkage (parallel)		parallel to flow	ISO 2577, CAMPUS	%	1.3						
molding shrinkage (normal)		perpendicular to flow	"	"							
processing shrinkage				"							
molecular weight distribution			GPC								

MECHANICAL PROPERTIES

tensile modulus (secant, 1 mm/min)	test temperature: 21-25°C; relative humidity: 50%; strain rate: 1 mm/min; elongation: 0.05-0.25%; atmosphere according to ISO 291	ISO 3167 multi-purpose test specimen	ISO 527-1, ISO 527-2, CAMPUS, DIN 53457	MPa	1500	1500	1650		2300	2500	2600
stress at yield (50 mm/min)	test temperature: 21-25°C; relative humidity: 50%; strain rate: 50 mm/min; atmosphere according to ISO 291	"	ISO 527-1, ISO 527-2, CAMPUS, DIN 53455	"	35	34	35		35	32	32
strain at yield (50 mm/min)	"	"	"	%	10	8	8		6	6	5
strain at break (50 mm/min)	"	"	"	"	>50	>50	>50		8	20	3
tensile strength at break (5 mm/min)	test temperature: 21-25°C; relative humidity: 50%; strain rate: 5 mm/min; atmosphere according to ISO 291	"	"	MPa							
strain at break (5mm/min)	"	"	"	%							
shear modulus	test temperature: 21-25°C; relative humidity: 50%		ISO 537, DIN 53445	MPa	750	800	850				
tensile creep modulus (1 hour)	test temperature: 21-25°C; relative humidity: 50%; elongation: <=0.5%; atmosphere according to ISO 291	ISO 3167 multi-purpose test specimen	ISO 899-1, CAMPUS	"	700				1600	1650	
tensile creep modulus (1000 hour)	"	"	"	"	380				800	850	
Charpy impact strength (23°C)	test temperature: 23°C; relative humidity: 50%; atmosphere according to ISO 291	80 x 10 x 4 mm	ISO 179/1eU, CAMPUS	kJ/m2	140	no failure	80		50	50	45
Charpy impact strength (-30°C)	test temperature: -30°C	"	"	"	16	20	15				
Charpy notched impact strength (23°C)	test temperature: 23°C; relative humidity: 50%; atmosphere according to ISO 291	80 x 10 x 4 mm, V notch, r= 0.25 mm	ISO 179/1eA, CAMPUS	"	3	4.5	3		2.5	4	3.2
Charpy notched impact strength (-30°C)	test temperature: -30°C	"	"	"	1.5	2.2	1.7				
Izod impact strength (23°C)	test temperature: 23°C; relative humidity: 50%	80 x 10 x 4 mm	ISO 180/1C	"	65	90	60				
Izod impact strength (-30°C)	test temperature: -30°C	"	"	kJ/m2	13	15	15				
notched Izod impact strength (23°C)	test temperature: 23°C; relative humidity: 50%	80 x 10 x 4 mm	ISO 180/1A	kJ/m2	3.5	4	2.2				
notched Izod impact strength (-30°C)	test temperature: -30°C	"	"	"	1.3	2	1.6				
notched tensile impact strength	test temperature: 23°C; relative humidity: 50%; atmosphere according to ISO 291	80 x 10 x 4 mm, 45° double V notch, r= 1.0 mm recommended	ISO 8256, CAMPUS	"					35	40	35
impact strength	test temperature: 23°C; relative humidity: 50%	small size standard test bar	DIN 53453	"					33	38	25
notched impact strength	"	"	"	"					2.5	5	3
Ball indentation hardness	load: 358 N; note: H 358/30	>=10 x >=10 x 4 mm	ISO 2039T1, DIN 2039T1	MPa	70	75	78		95	81	90

polypropylene, 40% talc	polypropylene, 20% glass fiber	polypropylene, 20% chemically coupled glass fibers	polypropylene, 30% chemically coupled glass fibers	polypropylene block copolymer	polypropylene block copolymer, UV stabilized	polypropylene random copolymer	polypropylene random copolymer	metallocene polypropylene	metallocene polypropylene	polypropylene, elastomer-modified	Polypropylene elastomer blend recycle	Material family
Hoechst	Hoechst	Hoechst	Hoechst	Vestolen GMBH	BASF	Vestolen GMBH	BASF	Hoechst	Hoechst	Hoechst	Hoechst	Supplier
Hostacom M4 N01	Hostacom G2 N01	Hostacom G2 U02	Hostacom G3 N01	Vestolen P 7700	Novolen 2660 M	Vestolen P 9421	Novolen 3240 NC	Hostacen XAV10A FOB	Hostacen XAW10A SAB	Hostalen PPN 8018A	Hostalen PP 3100	Material Trade Name
326, CAMPUS	326, CAMPUS	326, CAMPUS	326, CAMPUS	711, CAMPUS	CAMPUS	711, 712, CAMPUS	756, CAMPUS	709	731	841, CAMPUS	CAMPUS	Source ID
Test Notes												

PROCESSING PROPERTIES

2.5	2	17	1	2.5	10	0.4	16	30	60		9	melt volume rate (230°C, 2.16 kg)
4.5	3.5	28	2				30			6		melt volume rate (190°C, 5 kg)
11	8.5	55	5							35		melt volume rate (230°C, 5 kg)
2.5	1.7	15	1	1.9		0.3	11					melt flow rate (230°C, 2.16 kg)
4.5	3.2	23	2	4.5		0.5	22					melt flow rate (190°C, 5 kg)
11	7.5	55	4.5	10		1.5			26			melt flow rate (230°C, 5 kg)
					1.3		1.3					molding shrinkage (parallel)
												molding shrinkage (normal)
							0.6-2.0					processing shrinkage
								2.5	2.5			molecular weight distribution

MECHANICAL PROPERTIES

3800	2900	4600	6500	1500	1150	900	1100	1350	1450	850	900	tensile modulus (secant, 1 mm/min)
33	33	70		30	21	25	28			20	18	stress at yield (50 mm/min)
4	8			8	6	12	12			10	7	strain at yield (50 mm/min)
6	15		3	>50	>50	>50	>50			>50	>50	strain at break (50 mm/min)
		75	85			40 (strain rate: 50 mm/min; ISO 527)						tensile strength at break (5 mm/min)
		4	3									strain at break (5mm/min)
				650		400	550					shear modulus
2400	2300	3400	4800	1200						550		tensile creep modulus (1 hour)
1200	1300	2400	3200	450						250		tensile creep modulus (1000 hour)
30	50	40	40	no failure	no failure	no failure	200			no failure	no failure	Charpy impact strength (23°C)
				70	170	50	15			190		Charpy impact strength (-30°C)
3	4.5	9	9	9	45	20	6			65	NB	Charpy notched impact strength (23°C)
				4.5	6	2.5	1.5			8	5.5	Charpy notched impact strength (-30°C)
				no failure		no failure	non-breakable					Izod impact strength (23°C)
				65		30	20					Izod impact strength (-30°C)
				7		20	6.5					notched Izod impact strength (23°C)
				4		2.5	1.5					notched Izod impact strength (-30°C)
40	40	36	50									notched tensile impact strength
18	50	24	22									impact strength
4	5	7	6									notched impact strength
85	80	105	110				62	70	70			Ball indentation hardness

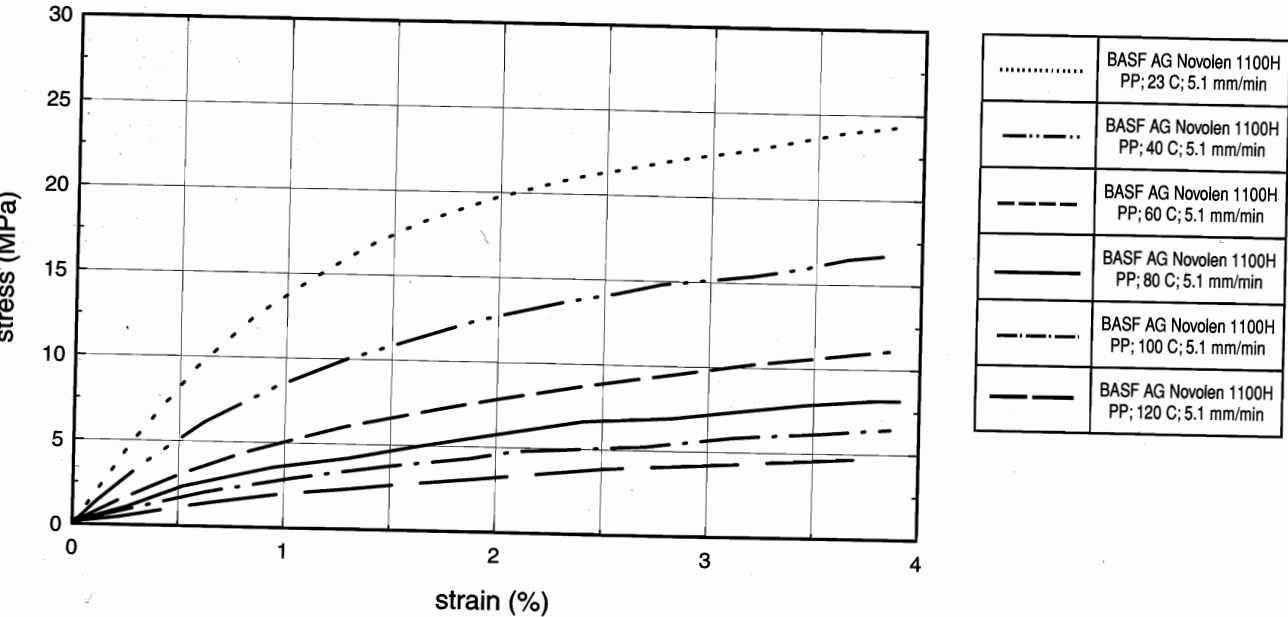
19.2 Film Properties

Table 19.1 Film Properties of Coated and Uncoated Oriented Polypropylene Film

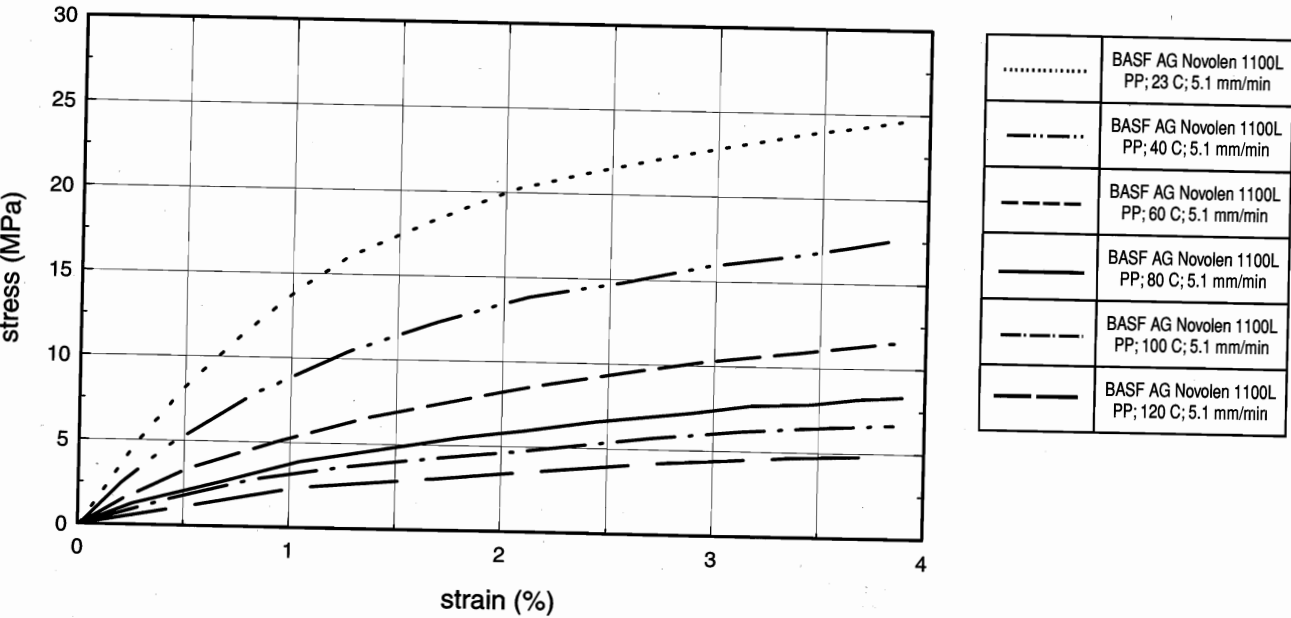
Material Family	POLYPROPYLENE	
Product Form	FILM	
Features	oriented	oriented; PVDC coated
Reference Number	268	268
MATERIAL CHARACTERISTICS		
Sample Thickness	0.02 mm	0.022 mm
TEST CONDITIONS		
Temperature (°C)	20	20
Relative Humidity (%)	65	65
PHYSICAL PROPERTIES		
Water Absorption - 24 hours (%)	0.3 (30°C)	0.3 (30°C)
Equilibrium Moist. Absorption (%)	0.2	0.2
MECHANICAL PROPERTIES		
Modulus Of Elasticity - MD (MPa)	1860 (ASTM D882)	2157 (ASTM D882)
Modulus Of Elasticity - TD (MPa)	3431 (ASTM D882)	2549 (ASTM D882)
Tensile Strength @ Break - MD (MPa)	127.6 (ASTM D882)	137.2 (ASTM D882)
Tensile Strength @ Break - TD (MPa)	245.5 (ASTM D882)	215.8 (ASTM D882)
Ultimate Elongation - MD (%)	140 (ASTM D882)	140 (ASTM D882)
Ultimate Elongation - TD (%)	50 (ASTM D882)	60 (ASTM D882)
Impact Strength (kg-cm)	9	9
Burst Strength (MPa)	0.39 (JIS P8112)	0.39 (JIS P8112)
Pinhole Strength (g)	690 (JAS)	790 (JAS)
Elmendorf Tear Resistance - MD (g/mm)	200 (JIS P8116)	300 (JIS P8116)
Elmendorf Tear Resistance - TD (g/mm)	100 (JIS P8116)	200 (JIS P8116)
Tear Resistance - MD (g)	260	300
Tear Resistance - TD (g)	220	200
OTHER PROPERTIES		
Melting Point (°C)	165	165
Haze (%)	2.2	3.5
Gloss		90
Surface Resistivity (ohms)	3.0 x 10 ¹⁵	4.2 x 10 ¹⁵
Slip Factor (°)	31	25
Dimensional Stability - MD (%)	-13.0	-10.4
Dimensional Stability - TD (%)	-15.0	-12.5

19.3 Stress vs. Strain Curves

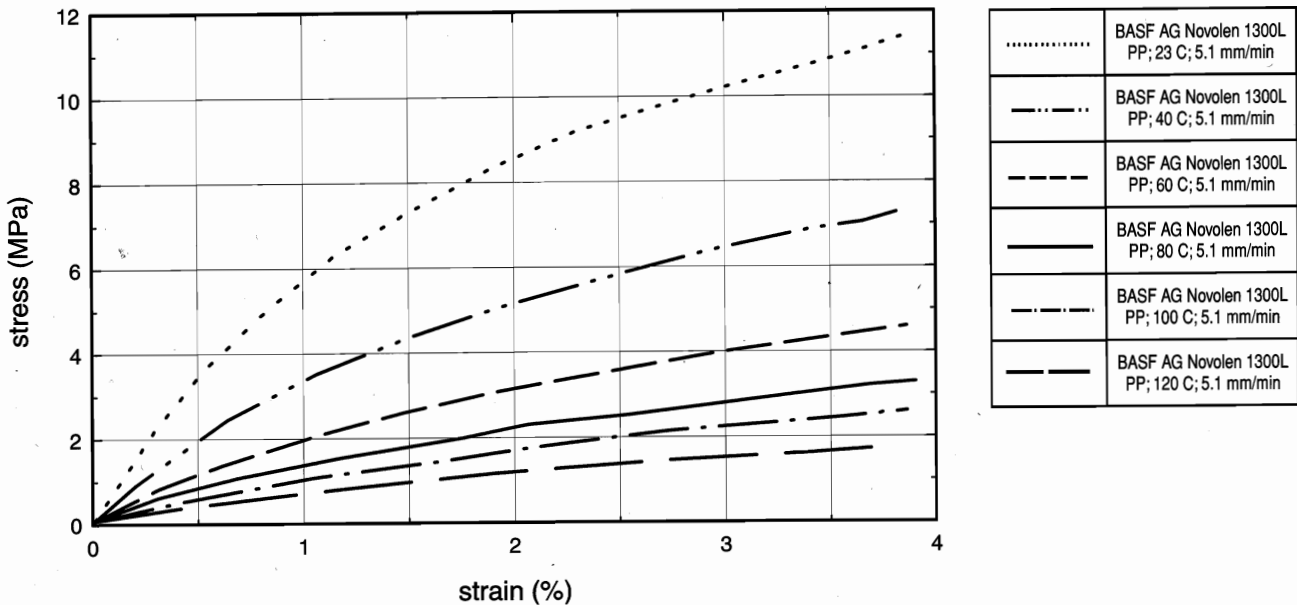
Graph 19.1 Stress vs. strain in tension for BASF AG Novolen 1100H polypropylene (melt volume index: 2.5 cc/ 10 min @ 230°C/ 2.16 kg, 4 cc/ 10 min @ 190°C/ 5 kg). Tested according to DIN 53455 at a strain rate of 5 mm/min.



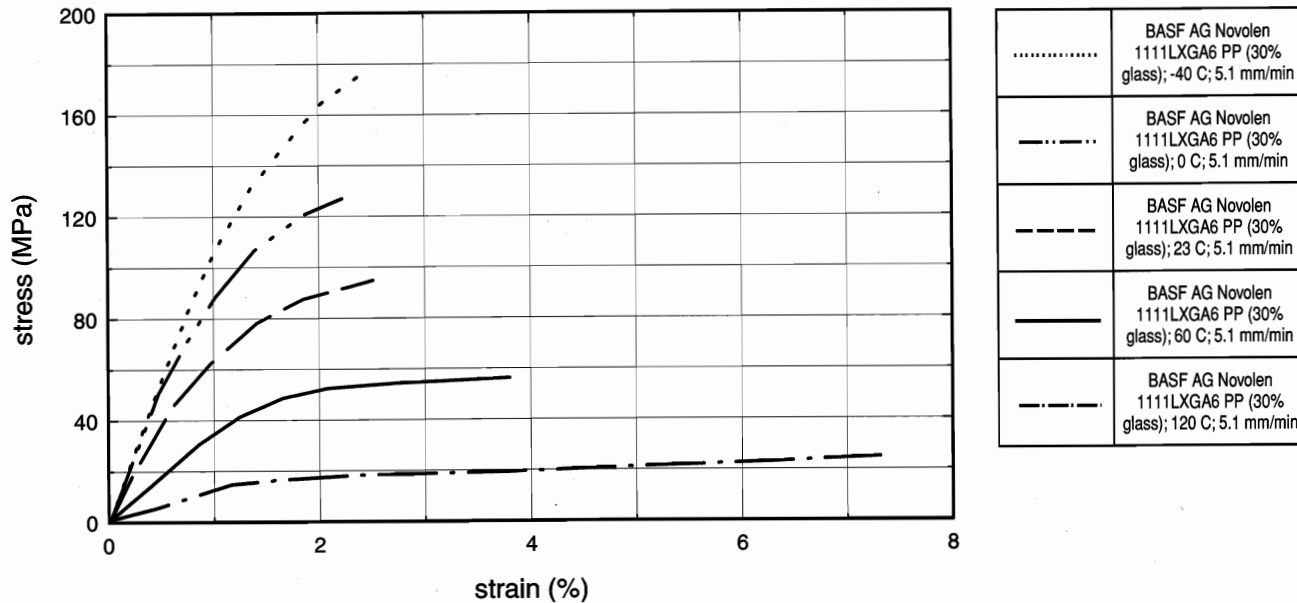
Graph 19.2 Stress vs. strain in tension for BASF AG Novolen 1100L polypropylene (melt volume index: 7 cc/ 10 min @ 230°C/ 2.16 kg, 13 cc/ 10 min @ 190°C/ 5 kg). Tested according to DIN 53455 at a strain rate of 5 mm/min.



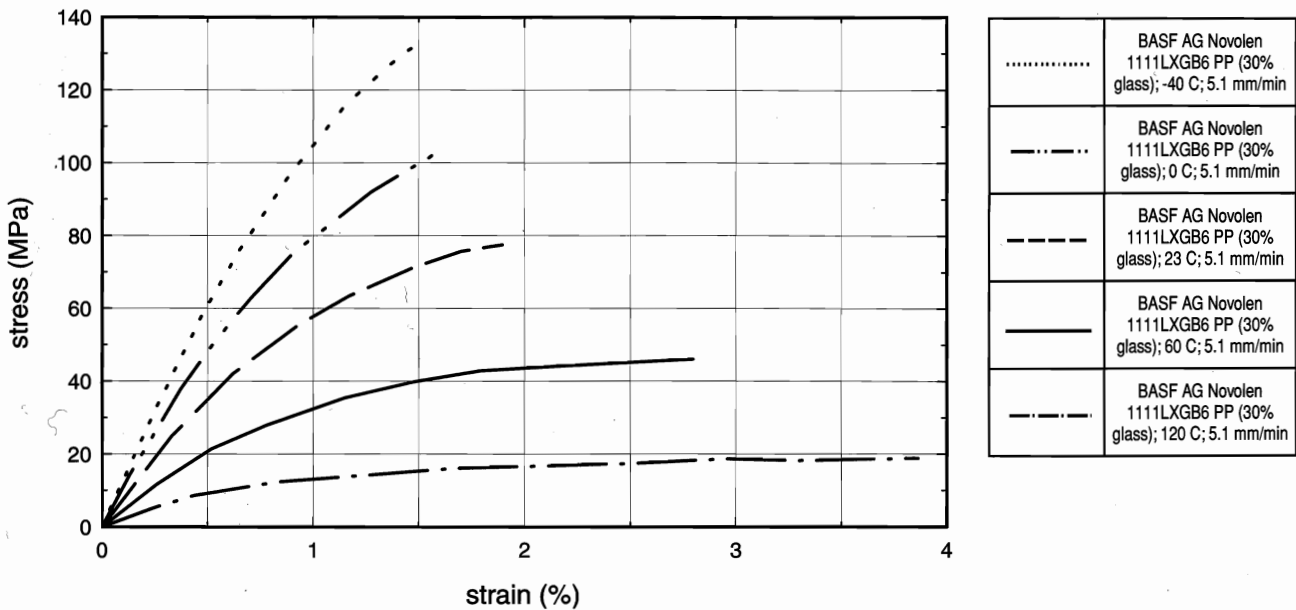
Graph 19.3 Stress vs. strain in tension for BASF AG Novolen 1300L polypropylene (melt volume index: 7 cc/ 10 min @ 230°C/ 2.16 kg, 10 cc/ 10 min @ 190°C/ 5 kg). Tested according to DIN 53455 at a strain rate of 5 mm/min.



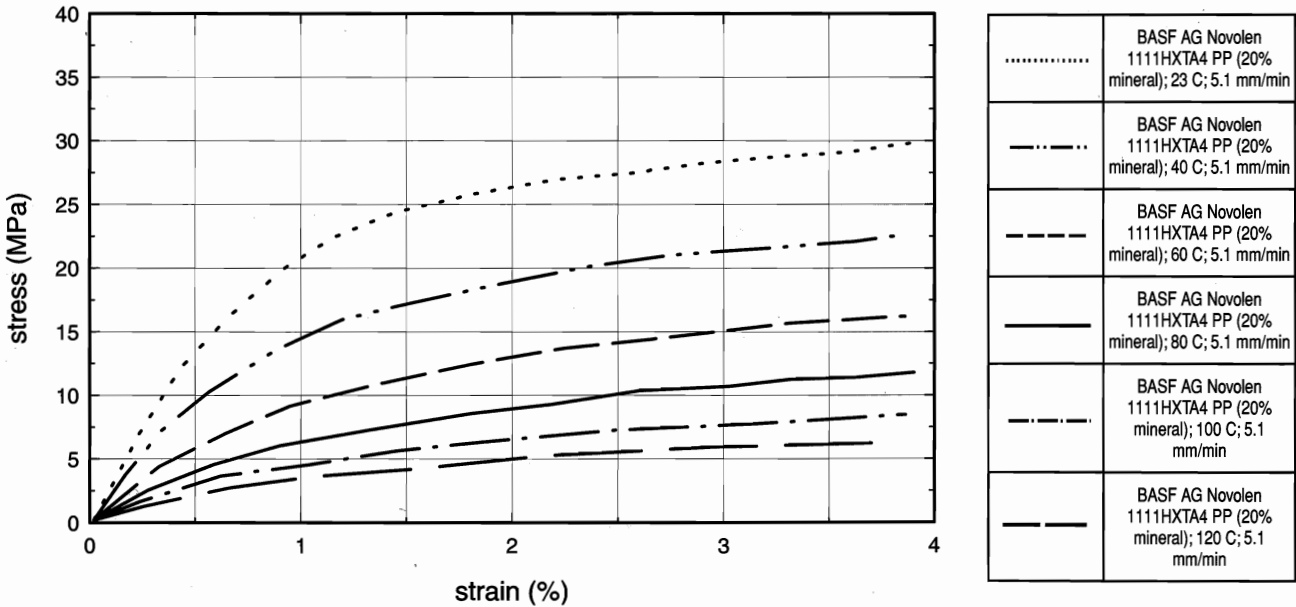
Graph 19.4 Stress vs. strain in tension for BASF AG Novolen 1111LXGA6 PP (30% glass; melt volume index: 2.4 cc/ 10 min @ 230°C/ 2.16 kg, 5.4 cc/ 10 min @ 190°C/ 5 kg). Tested according to DIN 53455 at a strain rate of 5 mm/min.



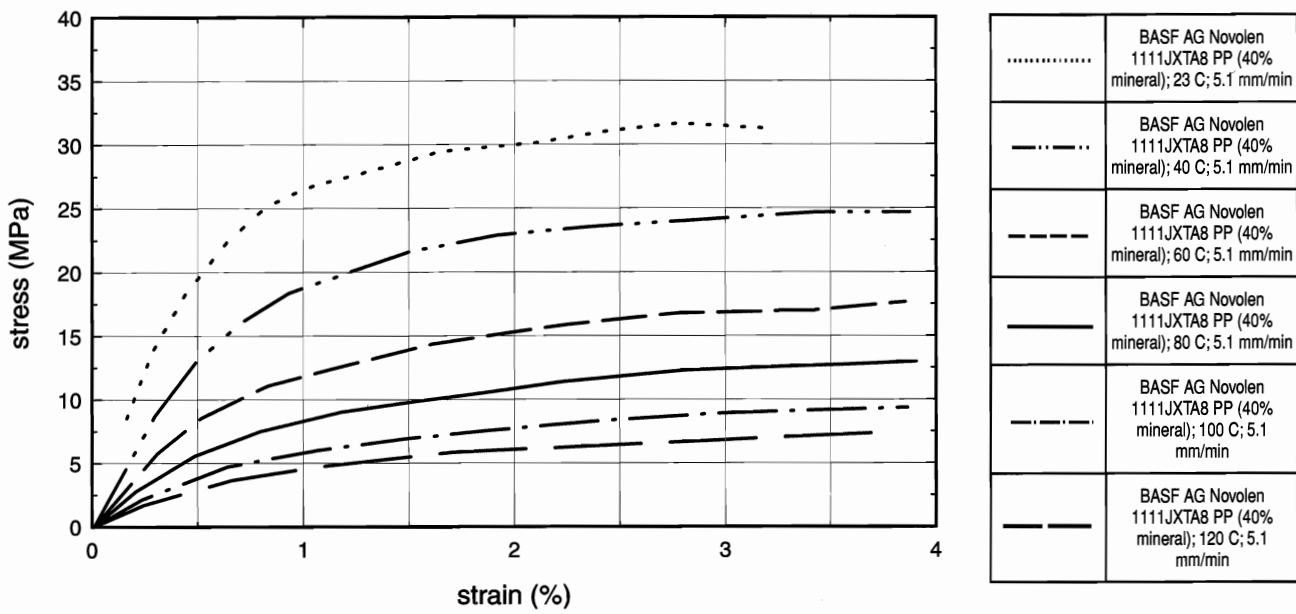
Graph 19.5 Stress vs. strain in tension for BASF AG Novolen 1111LXGB6 polypropylene (30% glass; melt volume index: 1.6 cc/ 10 min @ 230°C/ 2.16 kg, 5.2 cc/ 10 min @ 190°C/ 5 kg). Tested according to DIN 53455 at a strain rate of 5 mm/min.



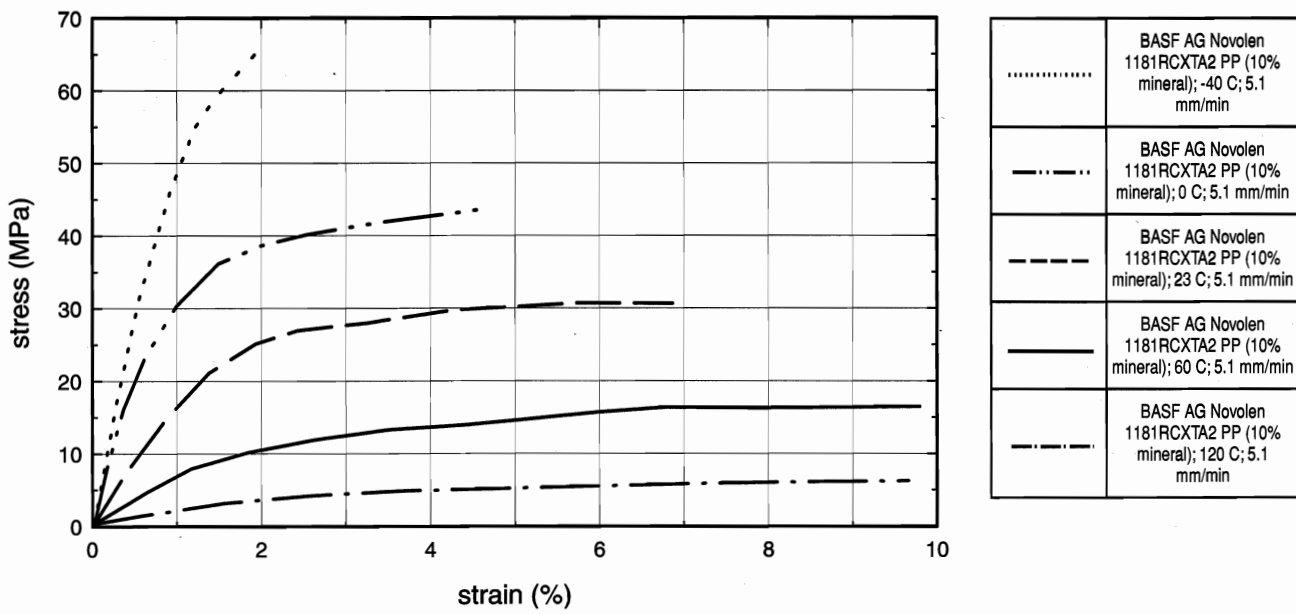
Graph 19.6 Stress vs. strain in tension for BASF AG Novolen 1111HXTA4 polypropylene (20% mineral; melt flow rate: 5 g/10 min.). Tested according to DIN 53455 at a strain rate of 5 mm/min.



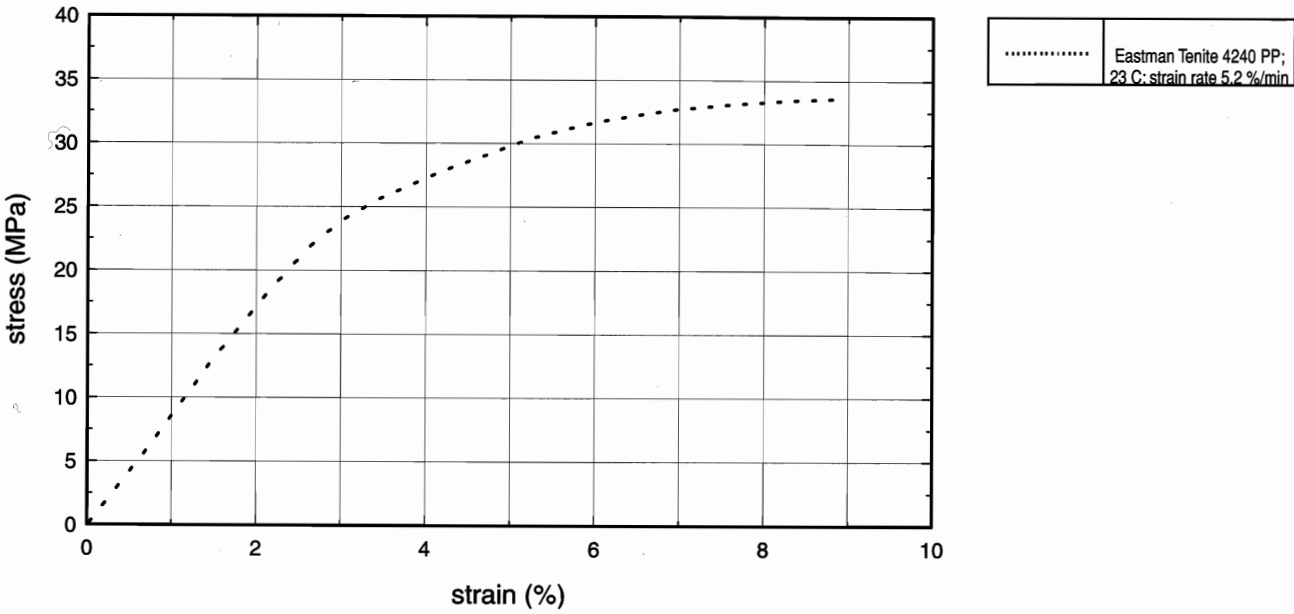
Graph 19.7 Stress vs. strain in tension for BASF AG Novolen 1111JXTA8 polypropylene (40% mineral; melt flow rate: 5 g/10 min.). Tested according to DIN 53455 at a strain rate of 5 mm/min.



Graph 19.8 Stress vs. strain in tension for BASF AG Novolen 1181RCXTA2 polypropylene (10% mineral; melt volume index: 28 cc/ 10 min @ 230°C/ 2.16 kg, 52 cc/ 10 min @ 190°C/ 5 kg). Tested according to DIN 53455 at a strain rate of 5 mm/min.

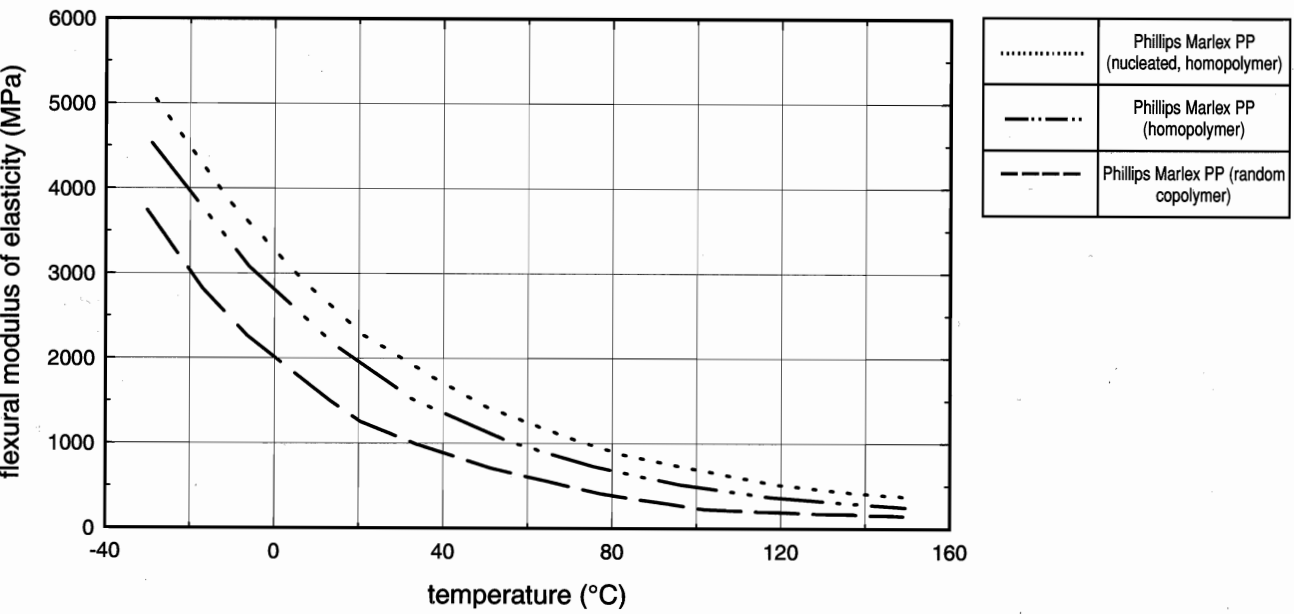


Graph 19.9 Stress vs. strain in tension for Eastman Tenite 4240 polypropylene (melt flow rate: 10 g/ 10min.). Tested at a strain rate of 5.2 %/min.

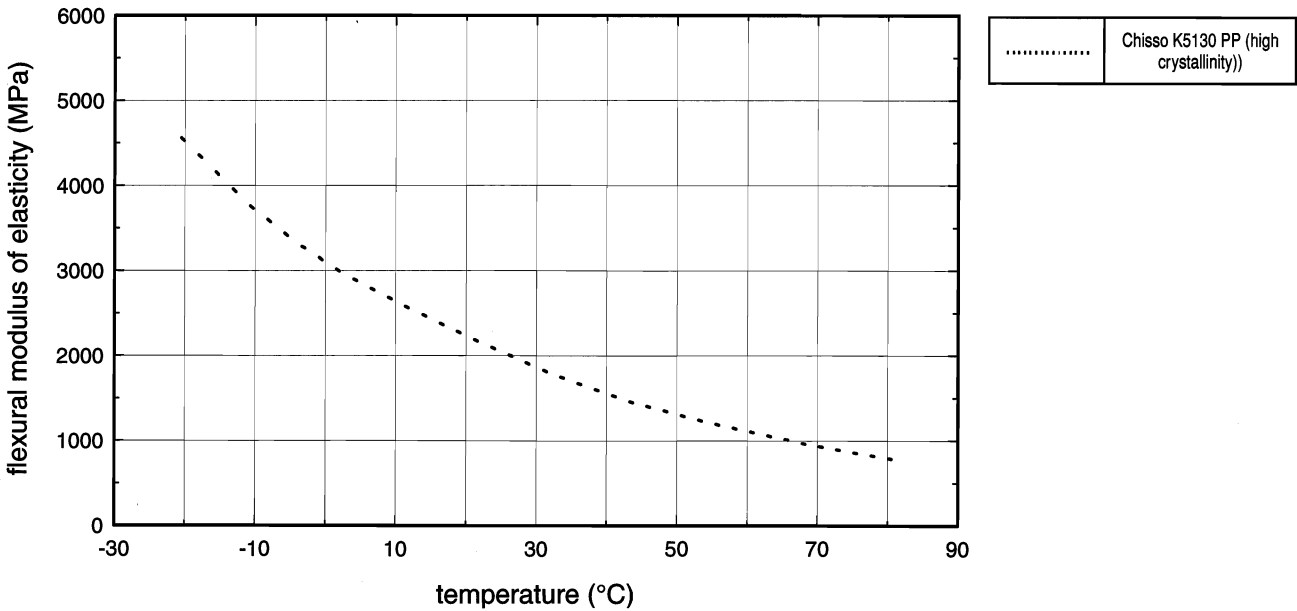


19.4 Temperature-Mechanical Property Relationship

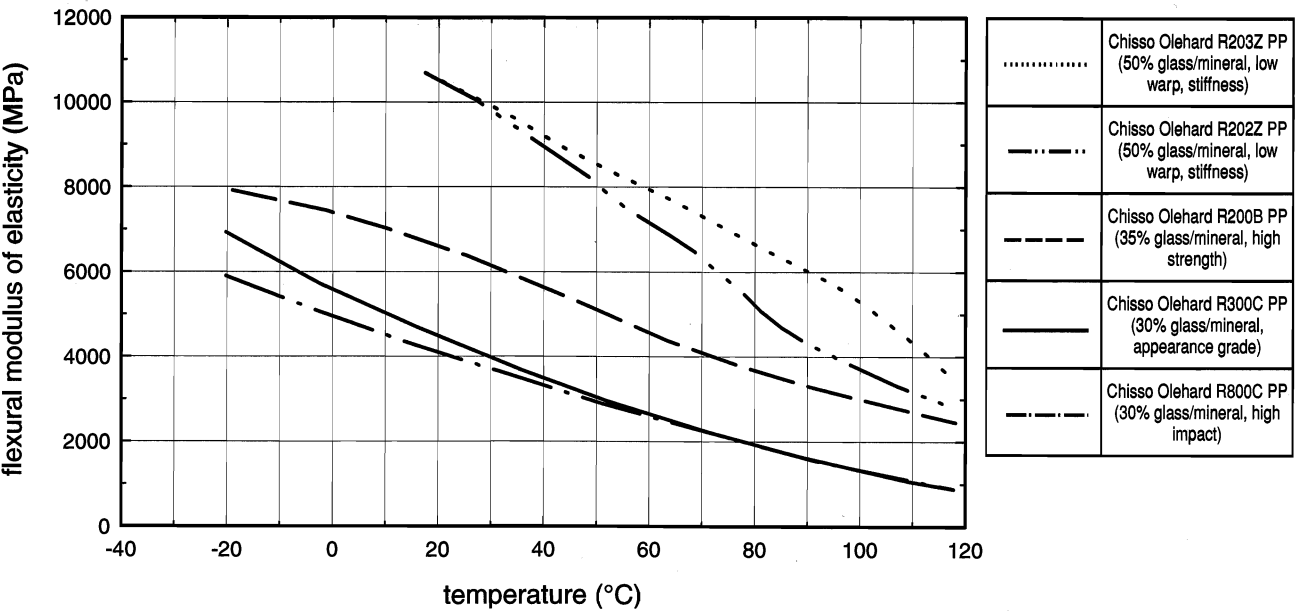
Graph 19.10 Flexural modulus of elasticity vs. temperature for Phillips Marlex polypropylene.



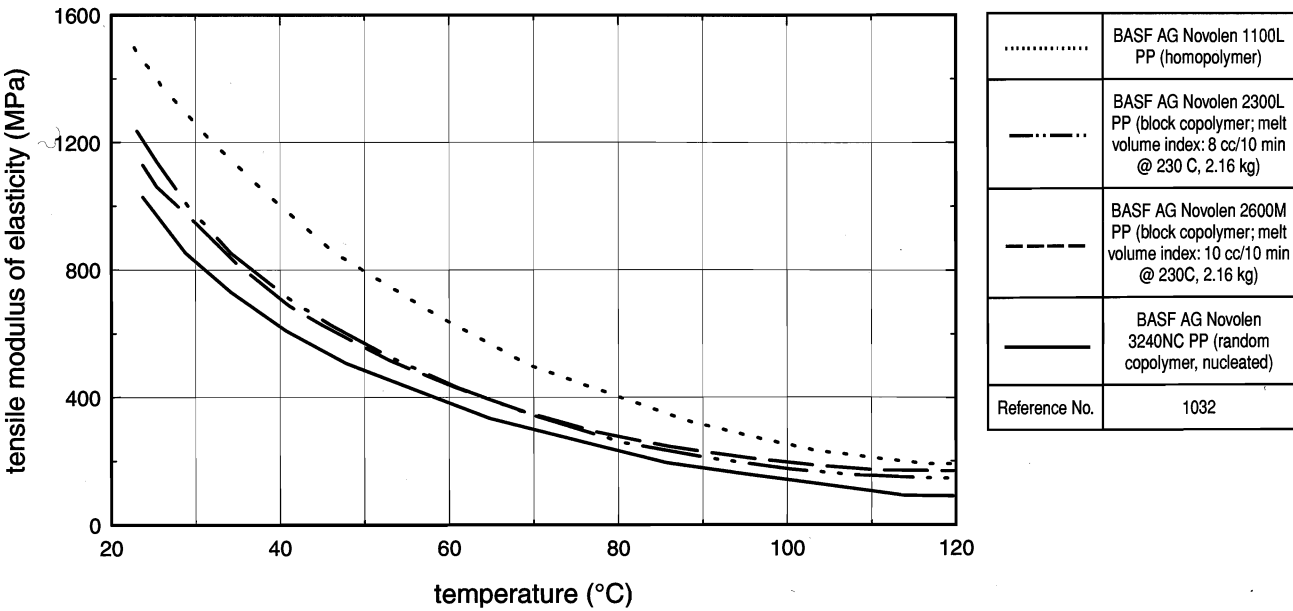
Graph 19.11 Flexural modulus of elasticity vs. temperature for Chisso high crystallinity polypropylene.



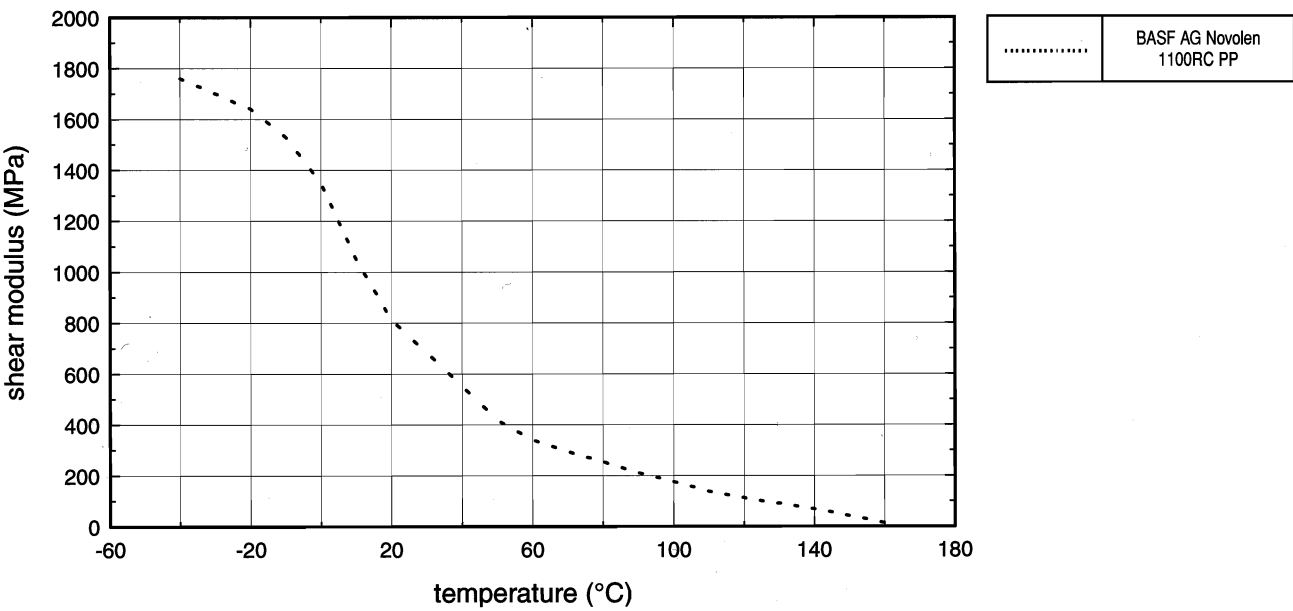
Graph 19.12 Flexural modulus of elasticity vs. temperature for Chisso Olehard glass/ mineral filled polypropylene.



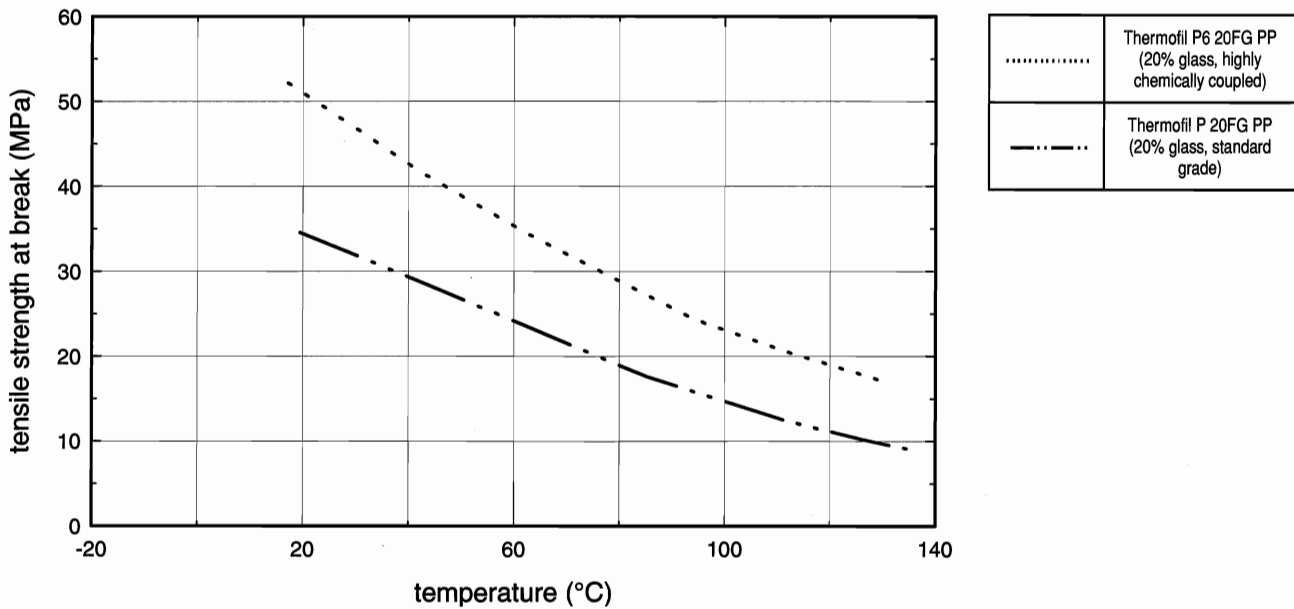
Graph 19.13 Tensile modulus of elasticity vs. temperature for BASF AG Novolen polypropylene.



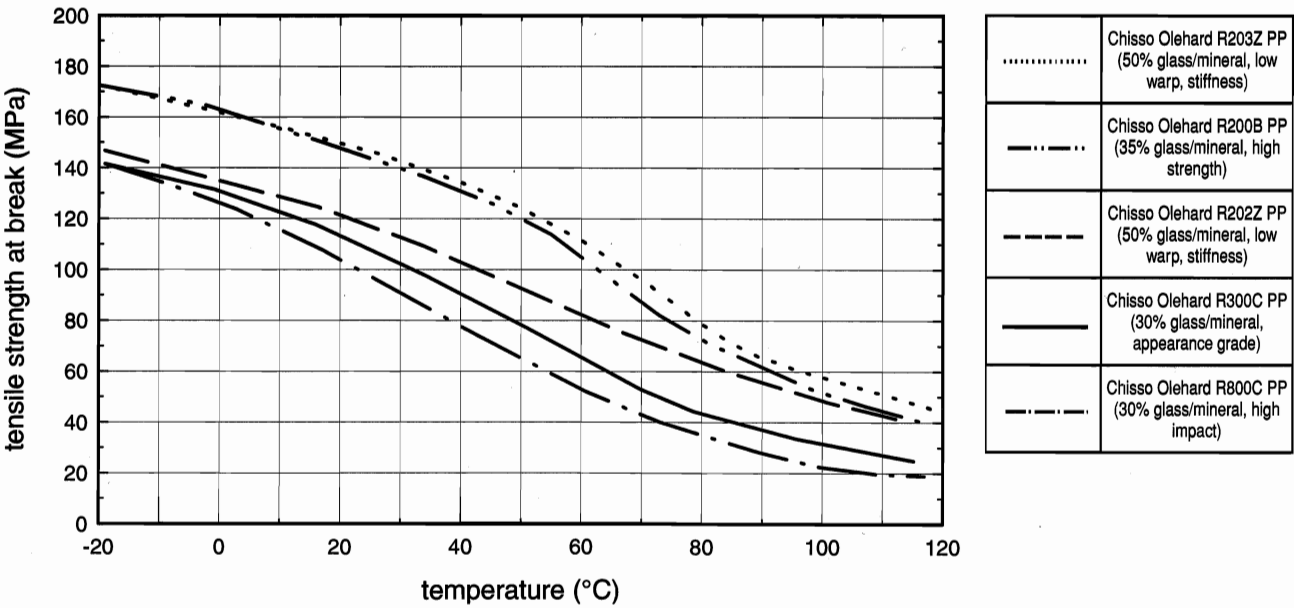
Graph 19.14 Shear modulus vs. temperature for BASF AG Novolen 1100RC polypropylene homopolymer.



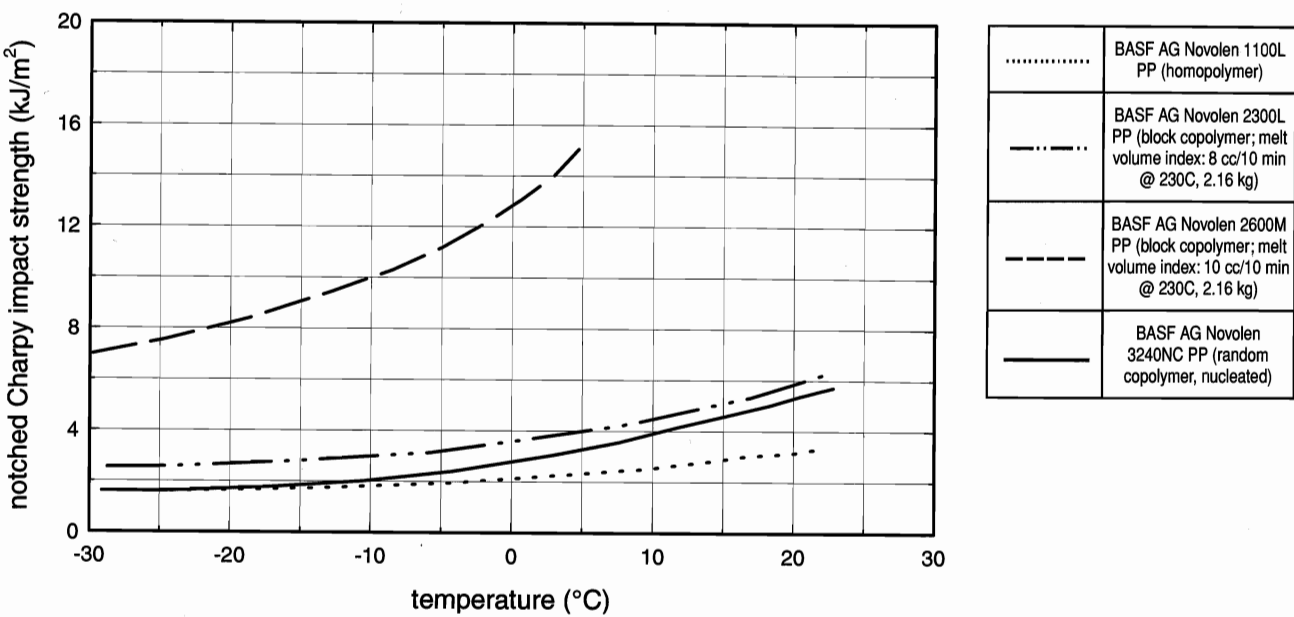
Graph 19.15 Tensile strength at break vs temperature for 20% glass fiber Thermofil Polypropylene.



Graph 19.16 Tensile strength at break vs temperature for glass fiber/ mineral filled Chisso Olehard Polypropylene.

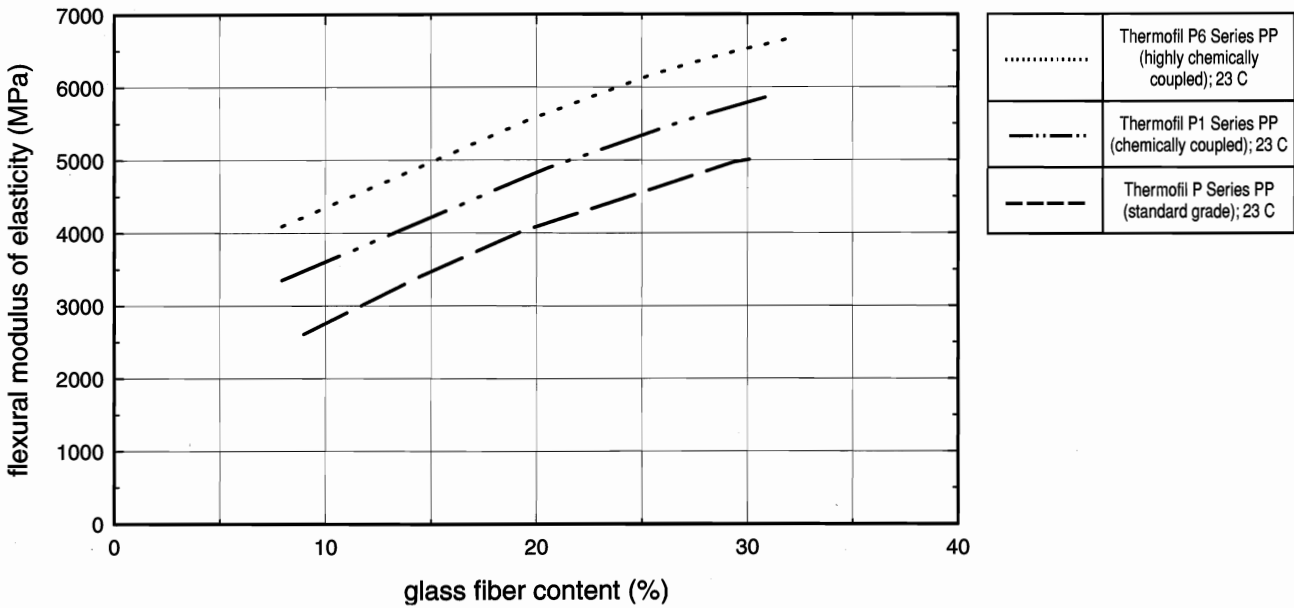


Graph 19.17 Notched Charpy impact strength vs. temperature for BASF AG Novolen polypropylene.

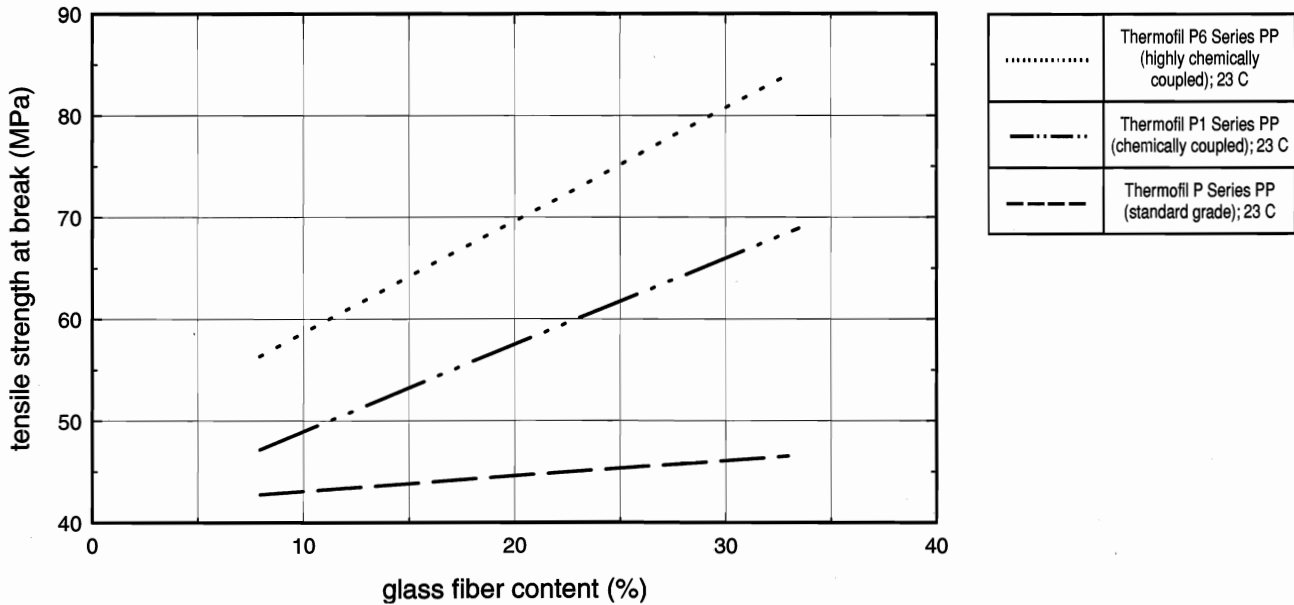


19.5 Composition-Mechanical Property Relationship

Graph 19.18 Flexural modulus of elasticity vs glass fiber content for Thermofil Polypropylene.

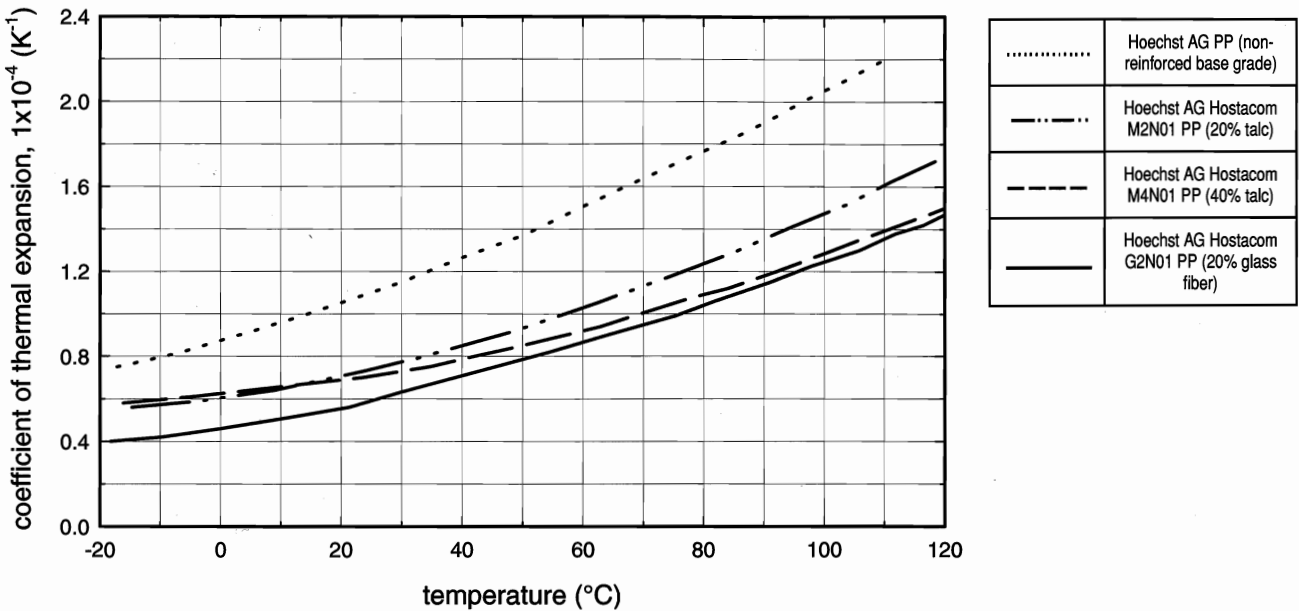


Graph 19.19 Tensile strength at break vs glass fiber content for Thermofil polypropylene.

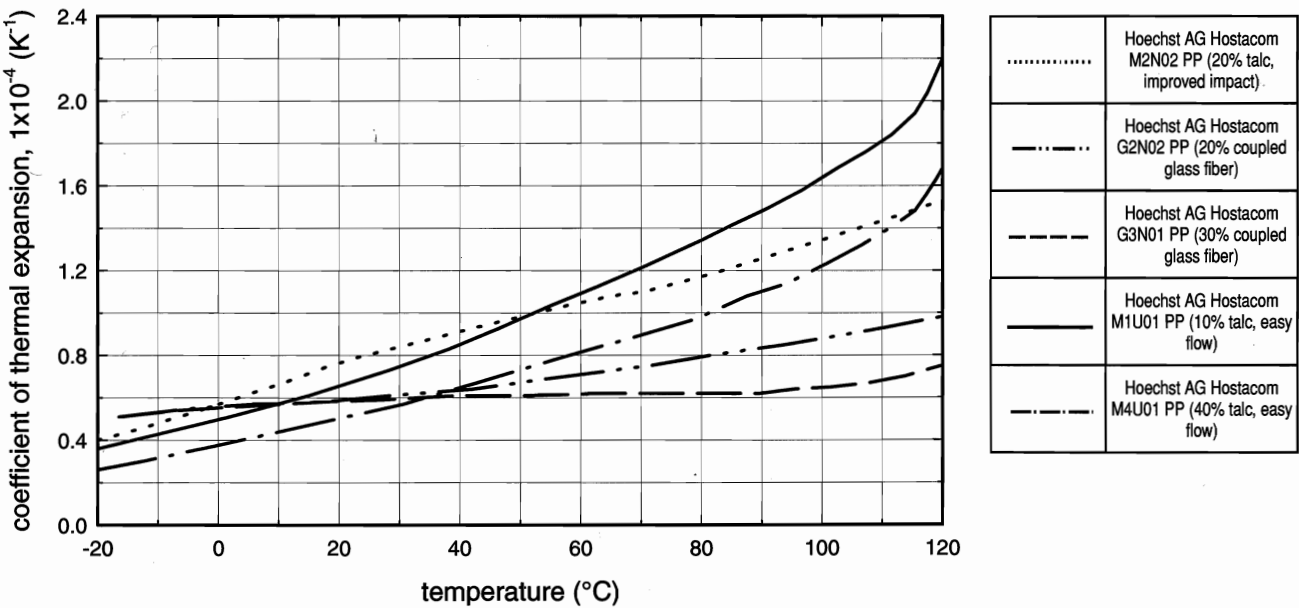


19.6 Temperature-Thermal Property Relationship

Graph 19.20 Coefficient of thermal expansion vs. temperature for Hoechst AG Hostacom polypropylene. Measured in flow direction.

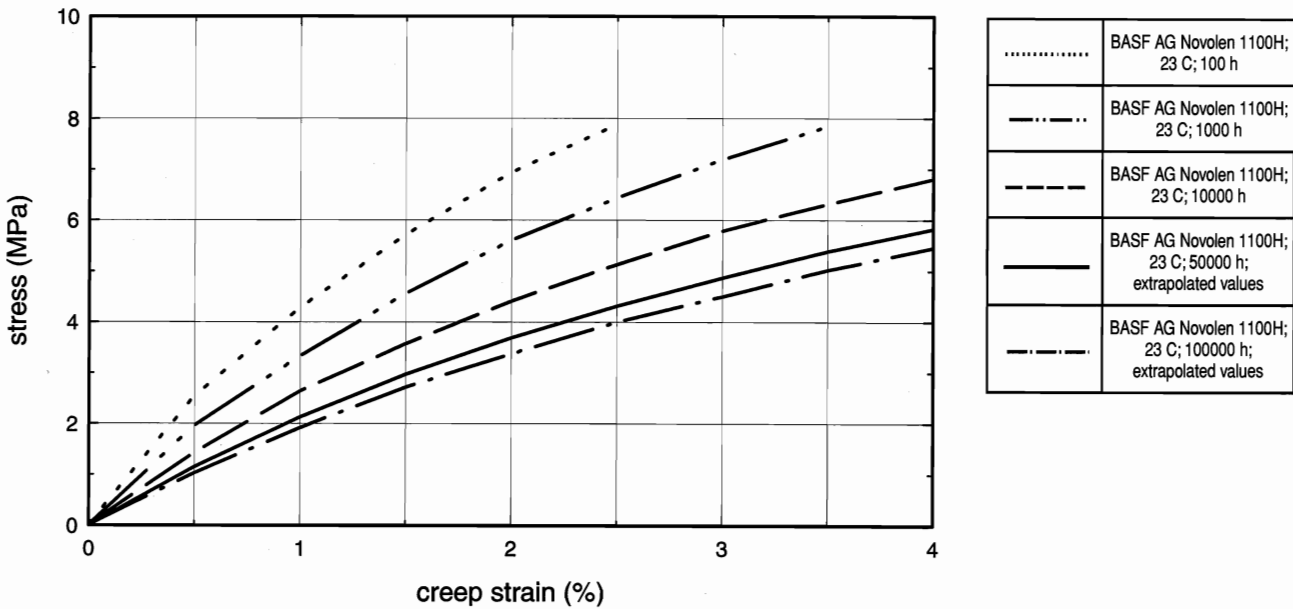


Graph 19.21 Coefficient of thermal expansion vs. temperature for Hoechst AG Hostacom polypropylene. Measured in flow direction.

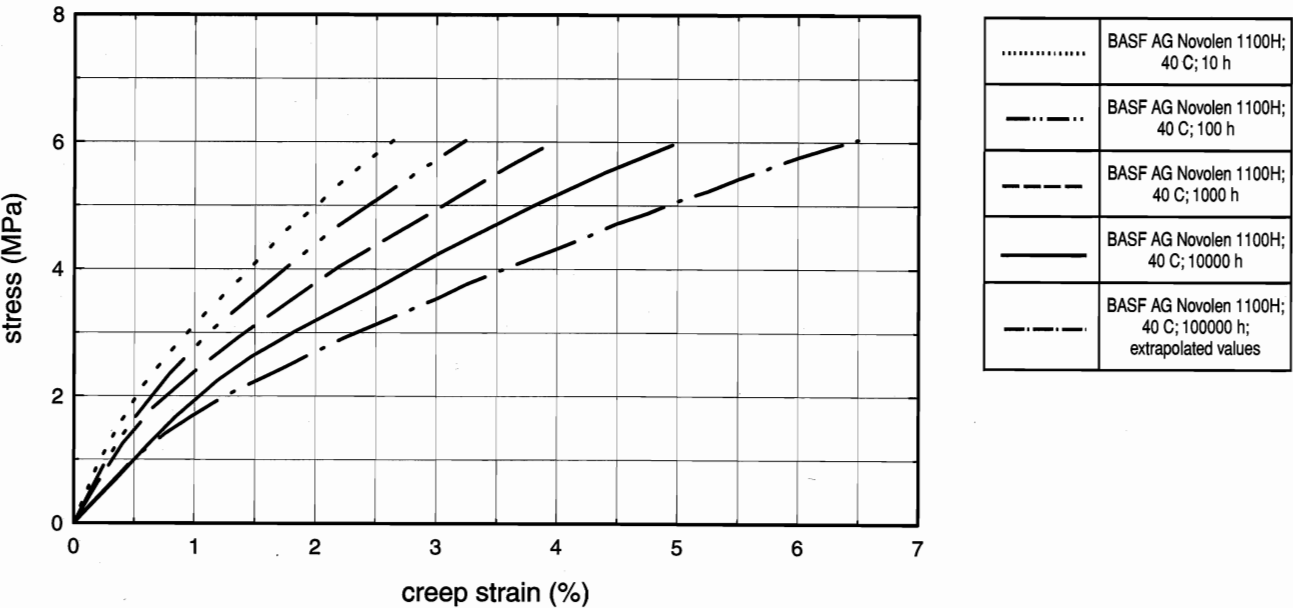


19.7 Creep and Stress Relaxation

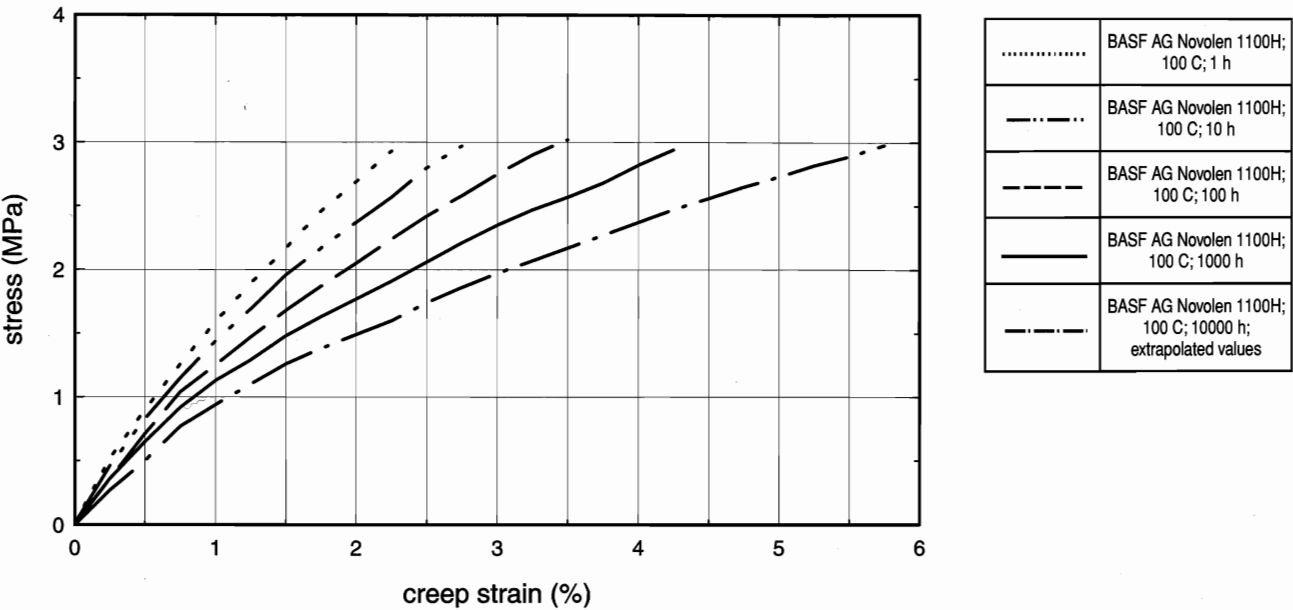
Graph 19.22 Isochronous stress vs. strain in tension @ 23°C for Novolen 1100H polypropylene (homopolymer; melt volume index: 2.5 cc/10 min. @ 230°C, 2.16 kg, 4 cc/10 min. @190°C, 5 kg). Tested according to DIN 53444.



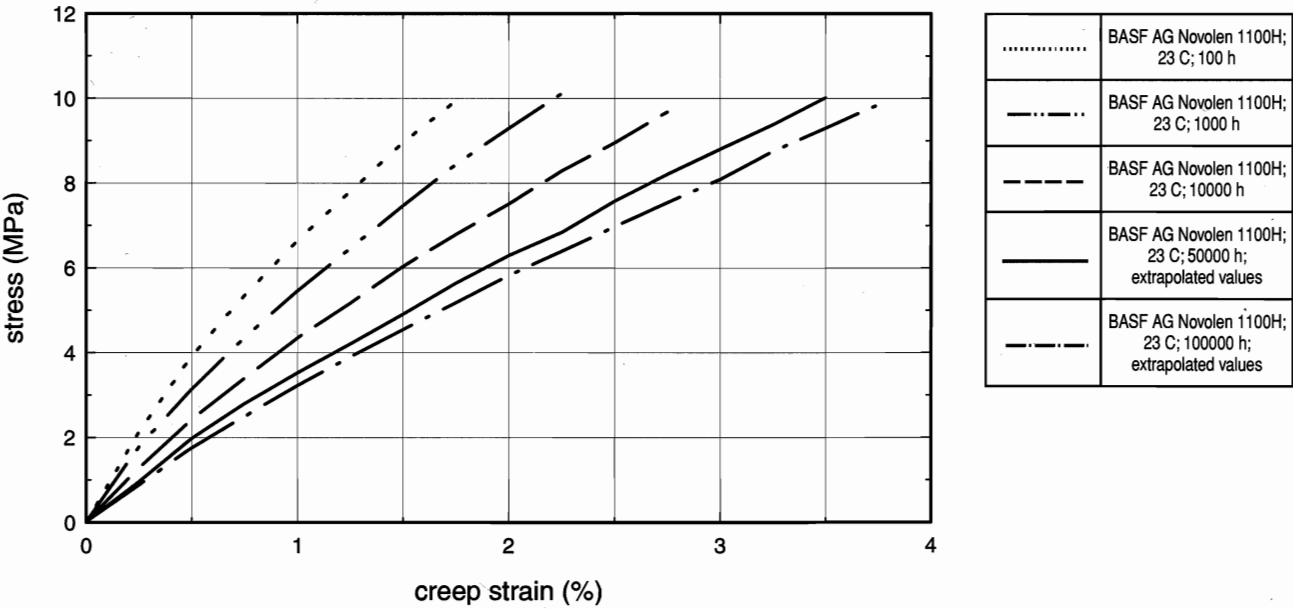
Graph 19.23 Isochronous stress vs. strain in tension @ 40°C for Novolen 1100H polypropylene (homopolymer; melt volume index: 2.5 cc/10 min. @ 230°C, 2.16 kg, 4 cc/10 min. @190°C, 5 kg). Tested according to DIN 53444.



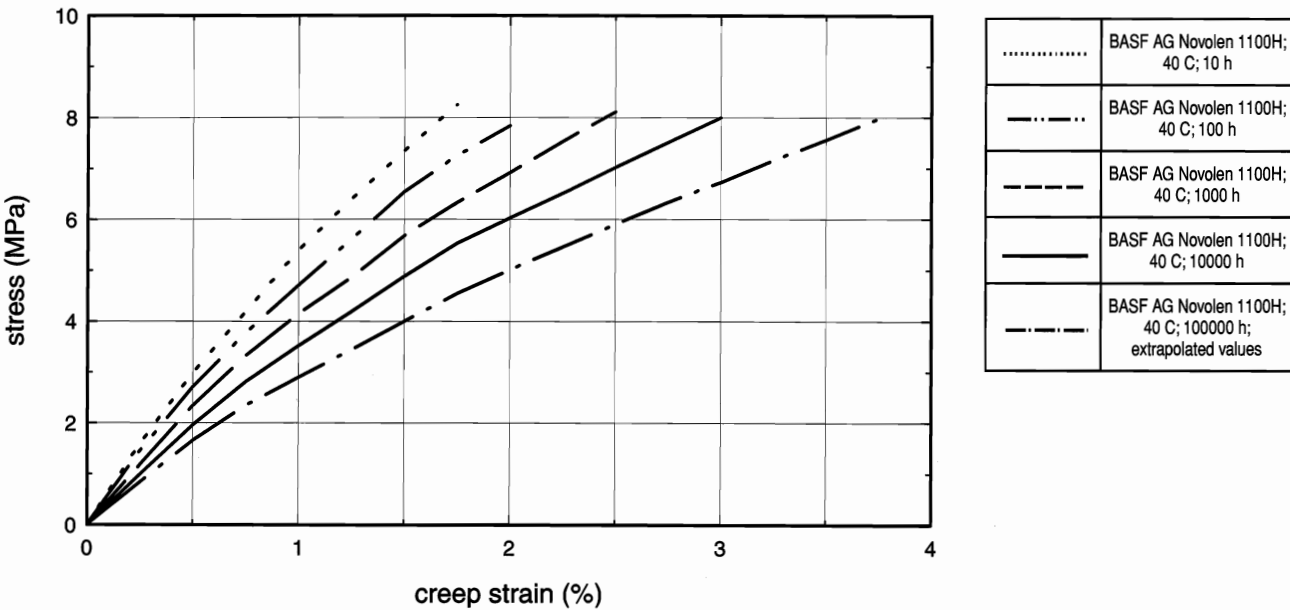
Graph 19.24 Isochronous stress vs. strain in tension @ 100°C for Novolen 1100H polypropylene (homopolymer; melt volume index: 2.5 cc/10 min. @ 230°C, 2.16 kg, 4 cc/10 min. @190°C, 5 kg). Tested according to DIN 53444.



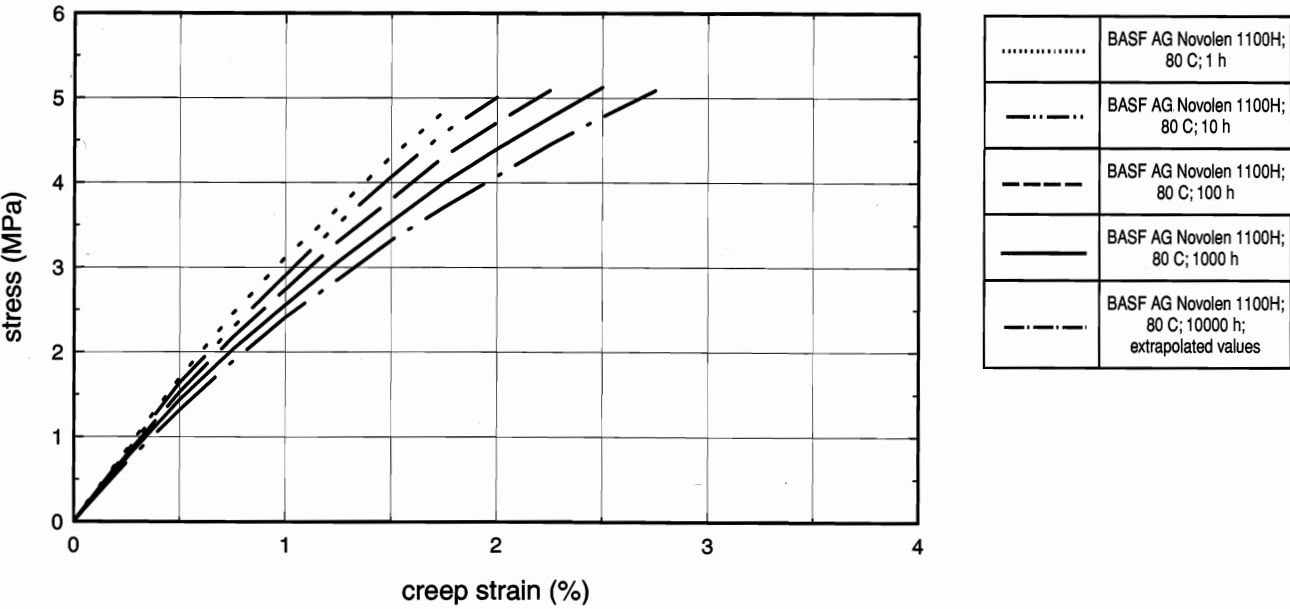
Graph 19.25 Isochronous stress vs. strain in compression @ 23°C for Novolen 1100H polypropylene (homopolymer; melt volume index: 2.5 cc/10 min. @ 230°C, 2.16 kg, 4 cc/10 min. @190°C, 5 kg). Tested according to DIN 53444.



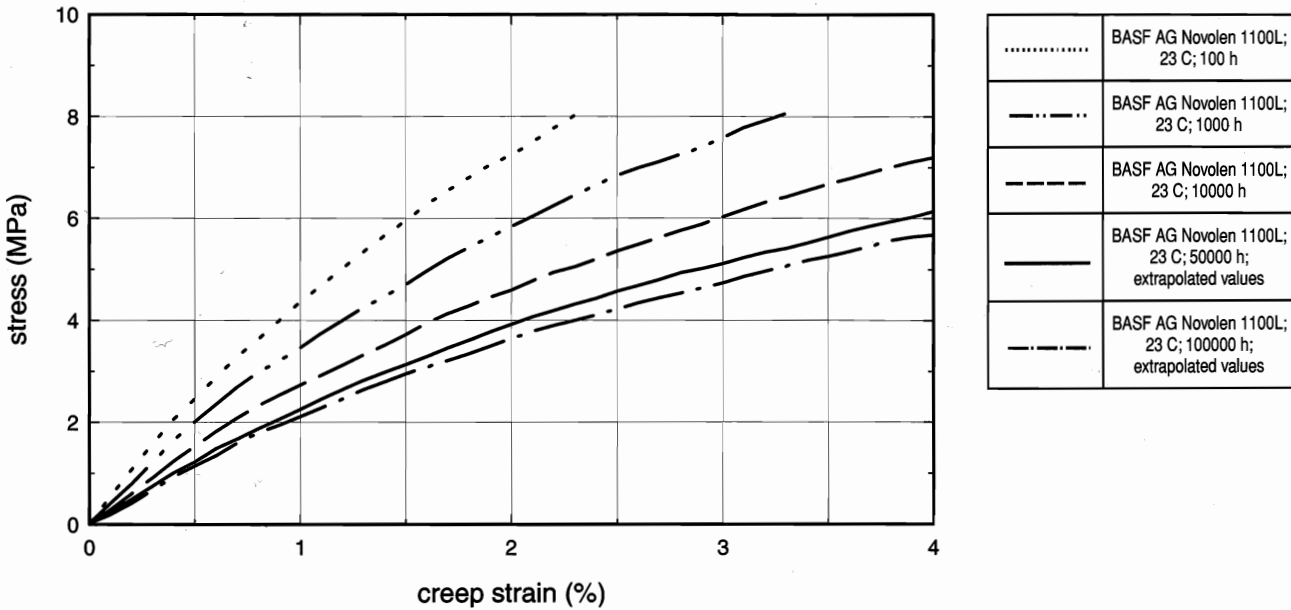
Graph 19.26 Isochronous stress vs. strain in compression @ 40°C for Novolen 1100H polypropylene (homopolymer; melt volume index: 2.5 cc/10 min. @ 230°C, 2.16 kg, 4 cc/10 min. @190°C, 5 kg). Tested according to DIN 53444.



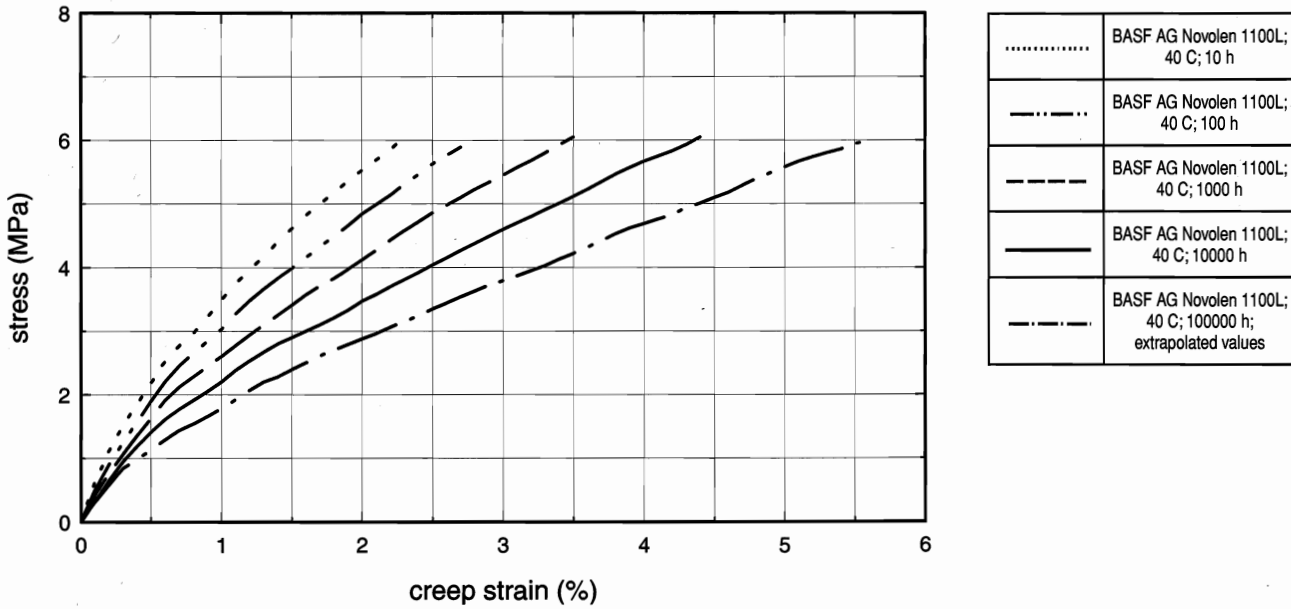
Graph 19.27 Isochronous stress vs. strain in compression @ 80°C for Novolen 1100H polypropylene (homopolymer; melt volume index: 2.5 cc/10 min. @ 230°C, 2.16 kg, 4 cc/10 min. @190°C, 5 kg). Tested according to DIN 53444.



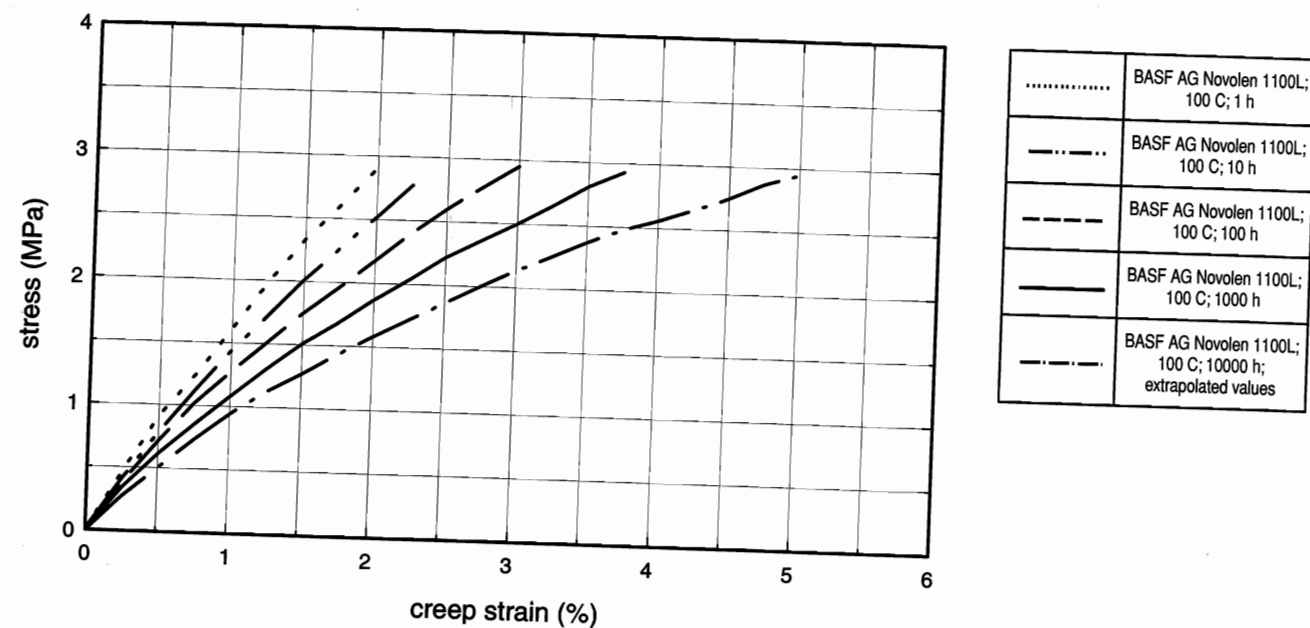
Graph 19.28 Isochronous stress vs. strain in tension @ 23°C for Novolen 1100L polypropylene (homopolymer; melt volume index: 7 cc/10 min. @ 230°C, 2.16 kg, 13 cc/10 min. @190°C, 5 kg). Tested according to DIN 53444.



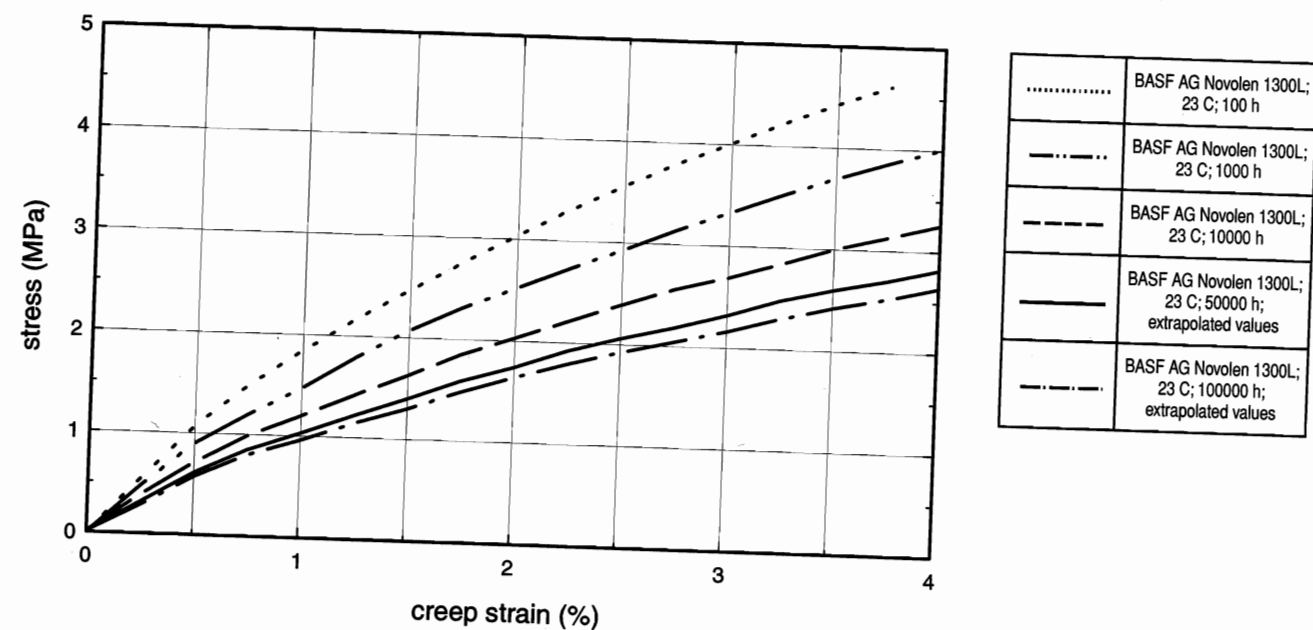
Graph 19.29 Isochronous stress vs. strain in tension @ 40°C for Novolen 1100L polypropylene (homopolymer; melt volume index: 7 cc/10 min. @ 230°C, 2.16 kg, 13 cc/10 min. @190°C, 5 kg). Tested according to DIN 53444.



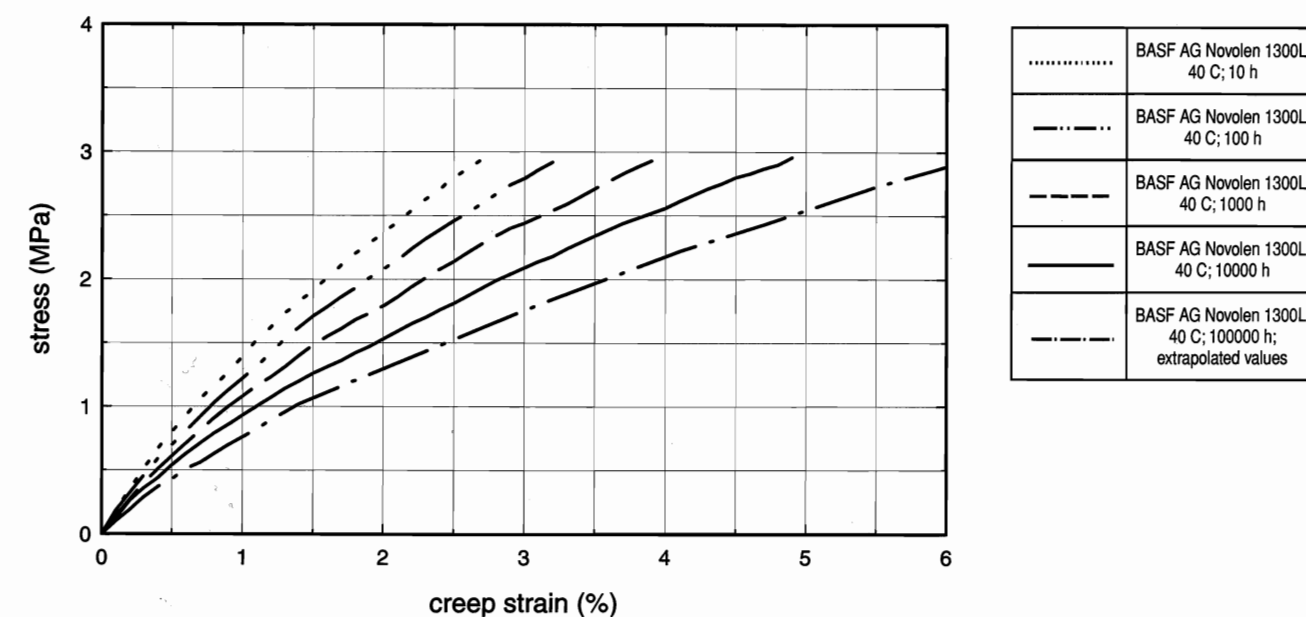
Graph 19.30 Isochronous stress vs. strain in tension @ 100°C for Novolen 1100L polypropylene (homopolymer; melt volume index: 7 cc/10 min. @ 230°C, 2.16 kg, 13 cc/10 min. @ 190°C, 5 kg). Tested according to DIN 53444.



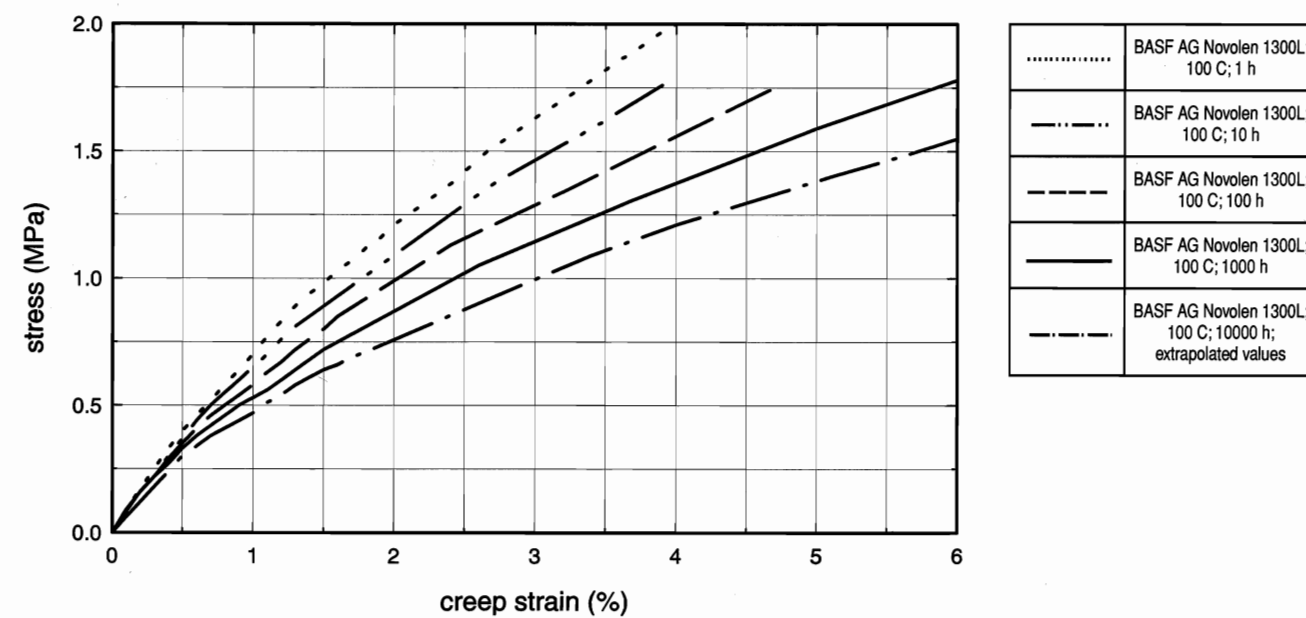
Graph 19.31 Isochronous stress vs. strain in tension @ 23°C for Novolen 1300L polypropylene (homopolymer; melt volume index: 7 cc/10 min. @ 230°C, 2.16 kg, 10 cc/10 min. @ 190°C, 5 kg). Tested according to DIN 53444.



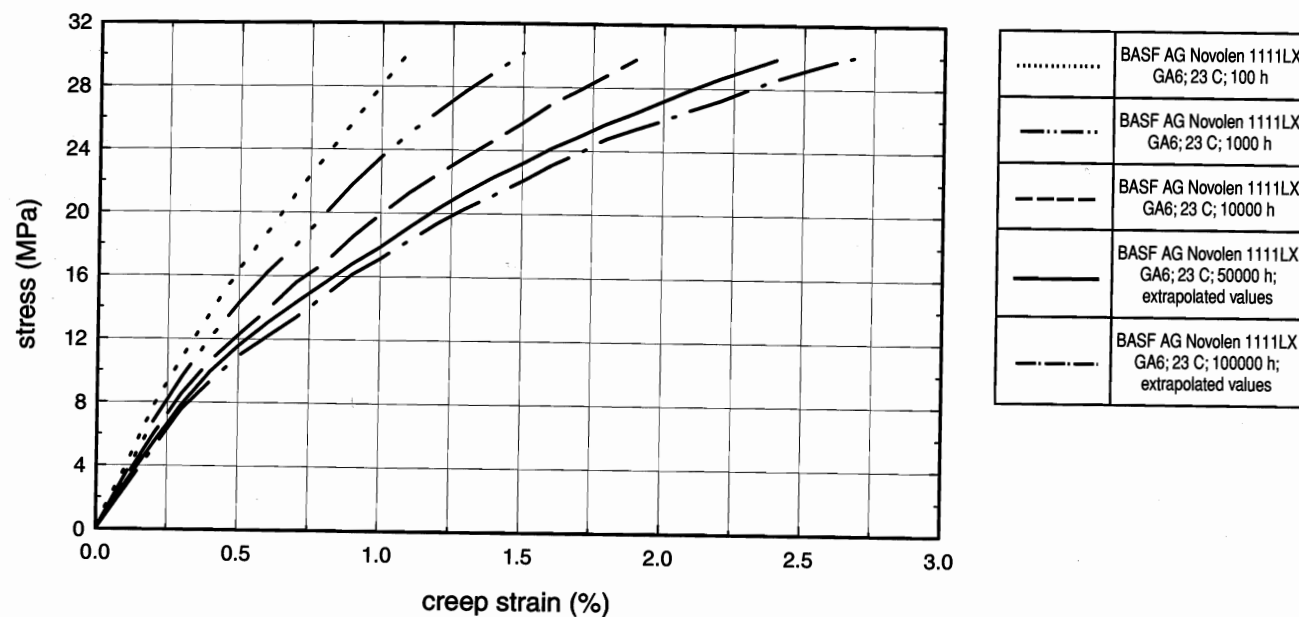
Graph 19.32 Isochronous stress vs. strain in tension @ 40°C for Novolen 1300L polypropylene (homopolymer; melt volume index: 7 cc/10 min. @ 230°C, 2.16 kg, 10 cc/10 min. @ 190°C, 5 kg). Tested according to DIN 53444.



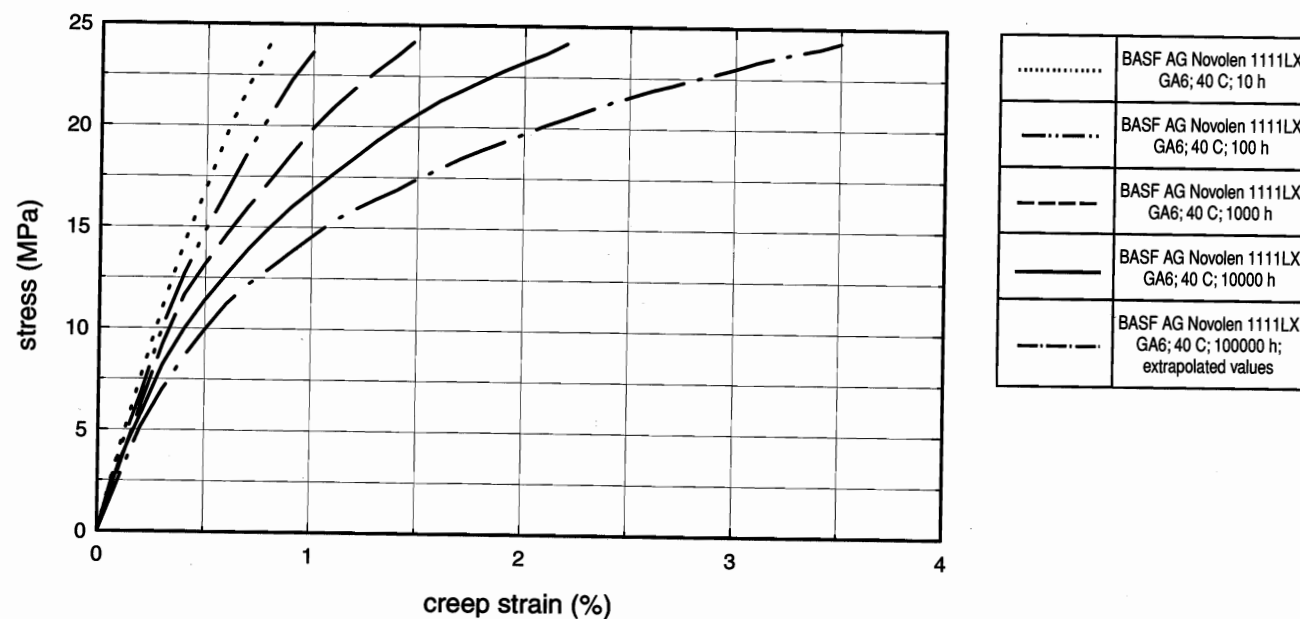
Graph 19.33 Isochronous stress vs. strain in tension @ 100°C for Novolen 1300L polypropylene (homopolymer; melt volume index: 7 cc/10 min. @ 230°C, 2.16 kg, 10 cc/10 min. @ 190°C, 5 kg). Tested according to DIN 53444.



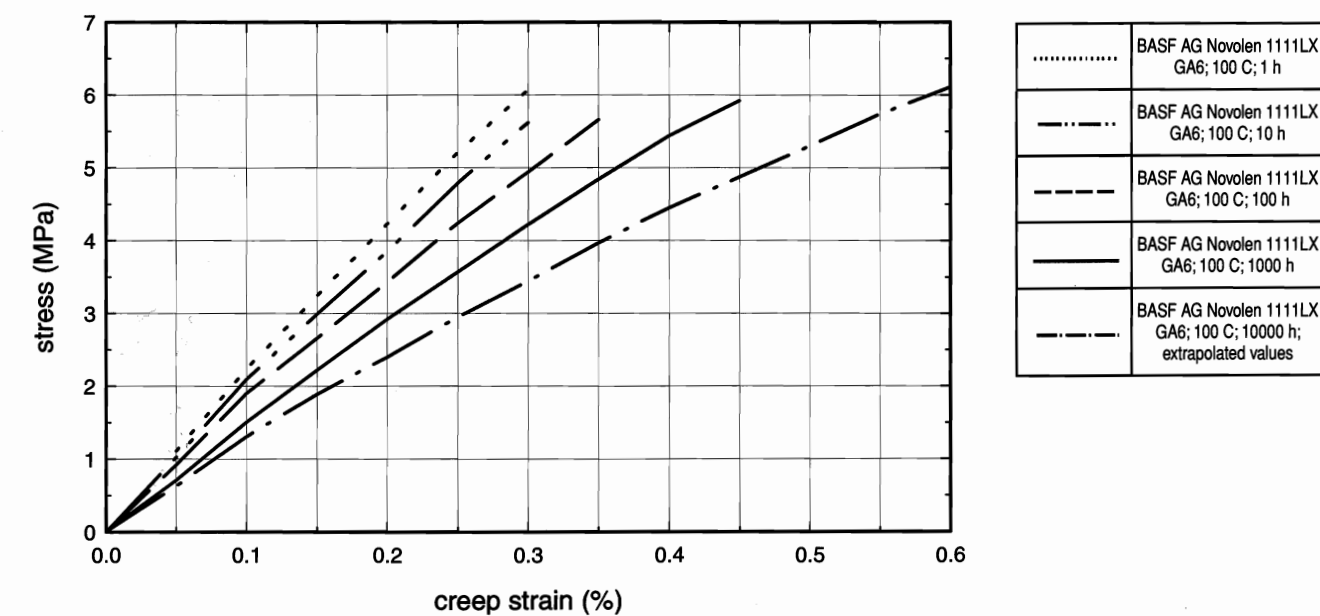
Graph 19.34 Isochronous stress vs. strain in tension @ 23°C for Novolen 1111LX GA6 polypropylene (30% glass fiber; melt volume index: 2.4 cc/10 min. @ 230°C, 2.16 kg, 5.4 cc/10 min. @ 190°C, 5 kg). Tested according to DIN 53444.



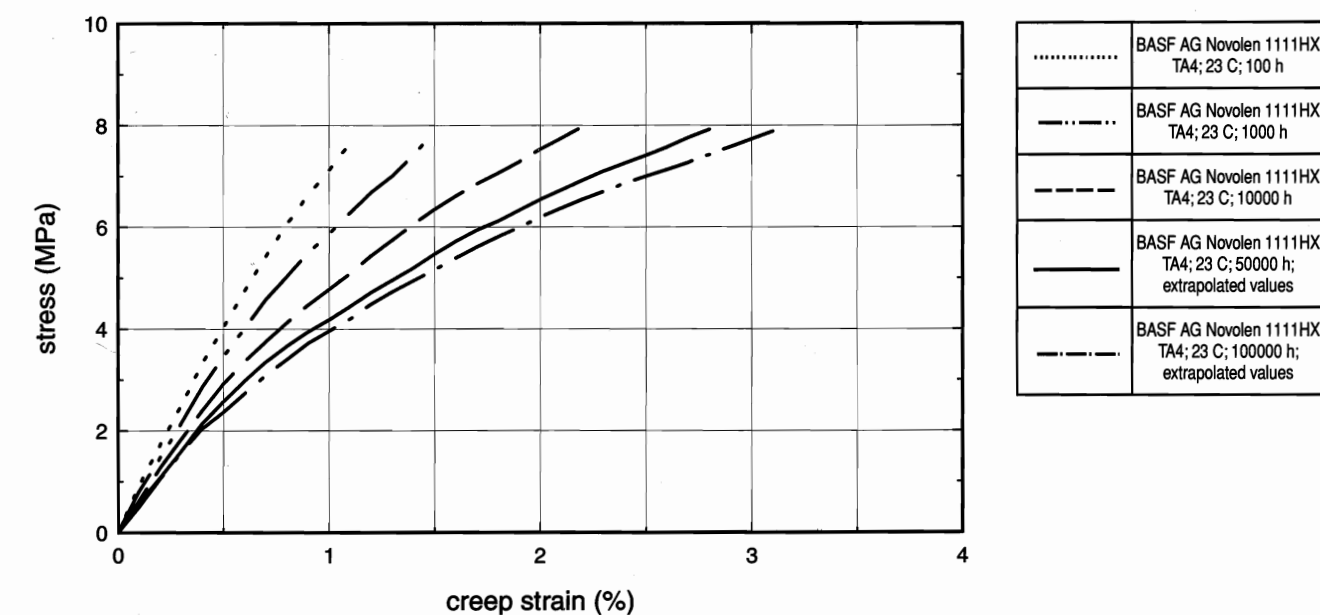
Graph 19.35 Isochronous stress vs. strain in tension @ 40°C for Novolen 1111LX GA6 polypropylene (30% glass fiber; melt volume index: 2.4 cc/10 min. @ 230°C, 2.16 kg, 5.4 cc/10 min. @ 190°C, 5 kg). Tested according to DIN 53444.



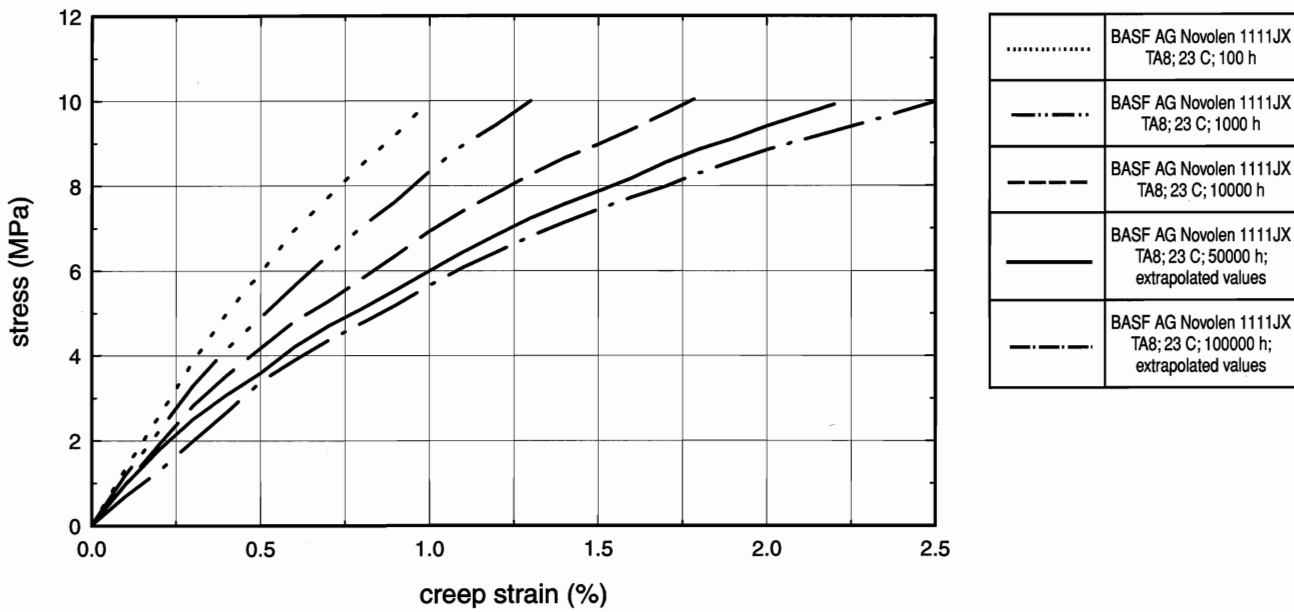
Graph 19.36 Isochronous stress vs. strain in tension @ 100°C for Novolen 1111LX GA6 polypropylene (30% glass fiber; melt volume index: 2.4 cc/10 min. @ 230°C, 2.16 kg, 5.4 cc/10 min. @ 190°C, 5 kg). Tested according to DIN 53444.



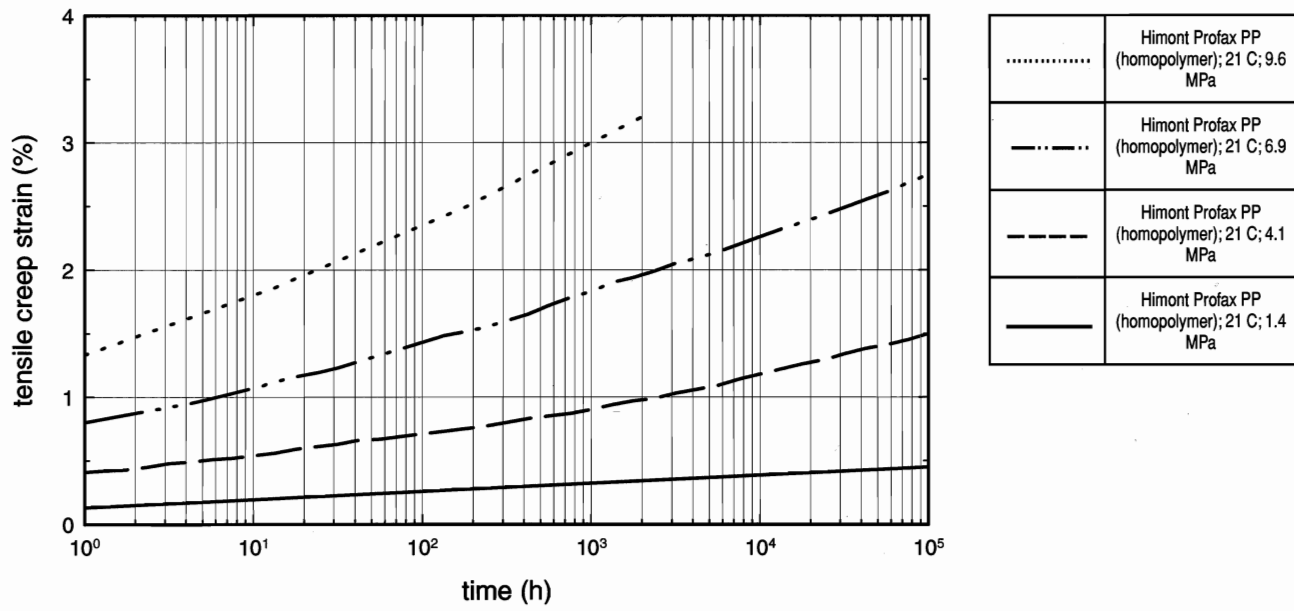
Graph 19.37 Isochronous stress vs. strain in tension @ 23°C for Novolen 1111HX TA4 polypropylene (20% mineral filler; melt flow: 5 g/10 min.). Tested according to DIN 53444.



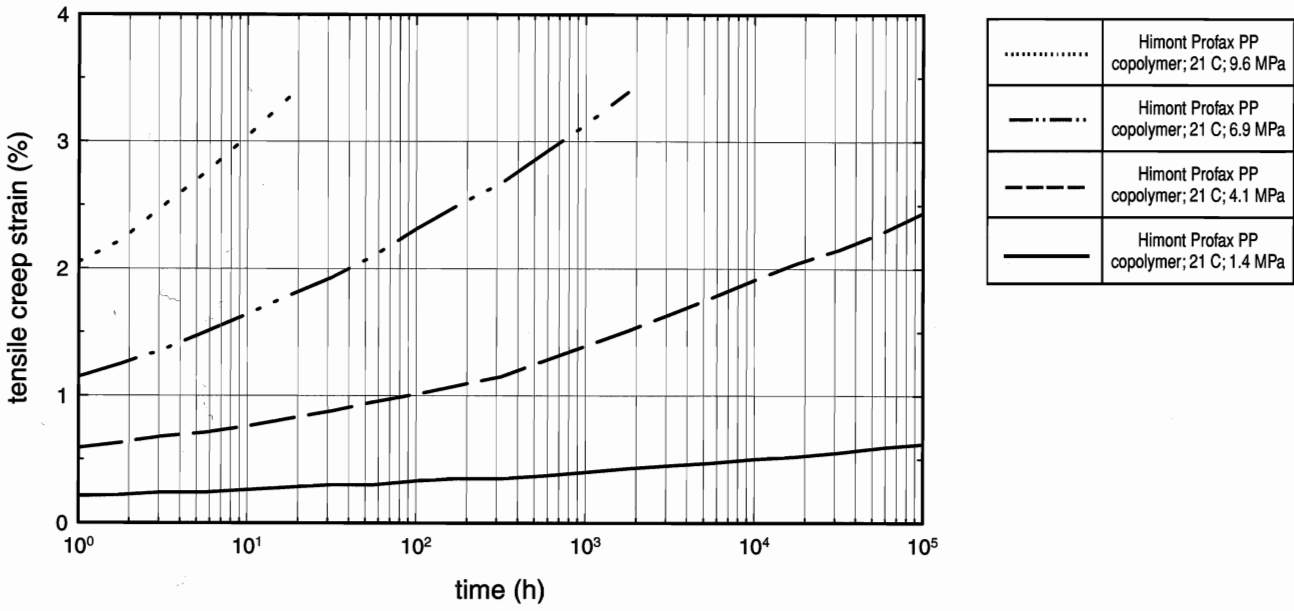
Graph 19.38 Isochronous stress vs. strain in tension @ 23°C for Novolen 1111JX TA8 polypropylene (40% mineral filler; melt flow: 5 g/10 min). Tested according to DIN 53444.



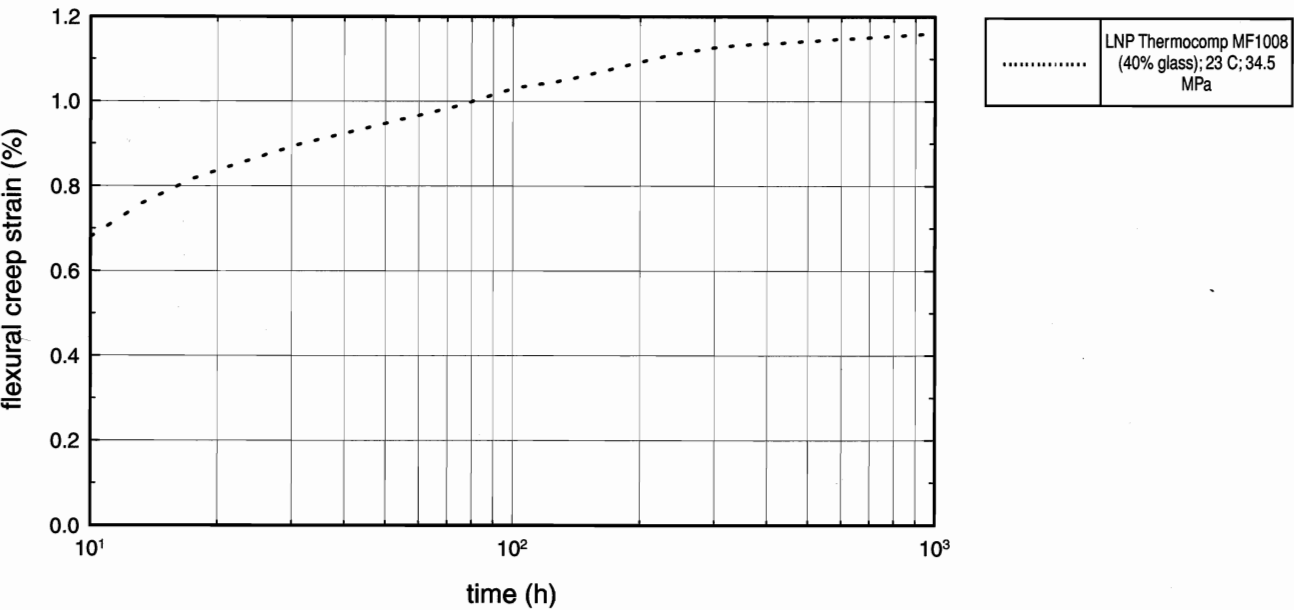
Graph 19.39 Tensile creep strain vs time for Himont Profax polypropylene (homopolymer).



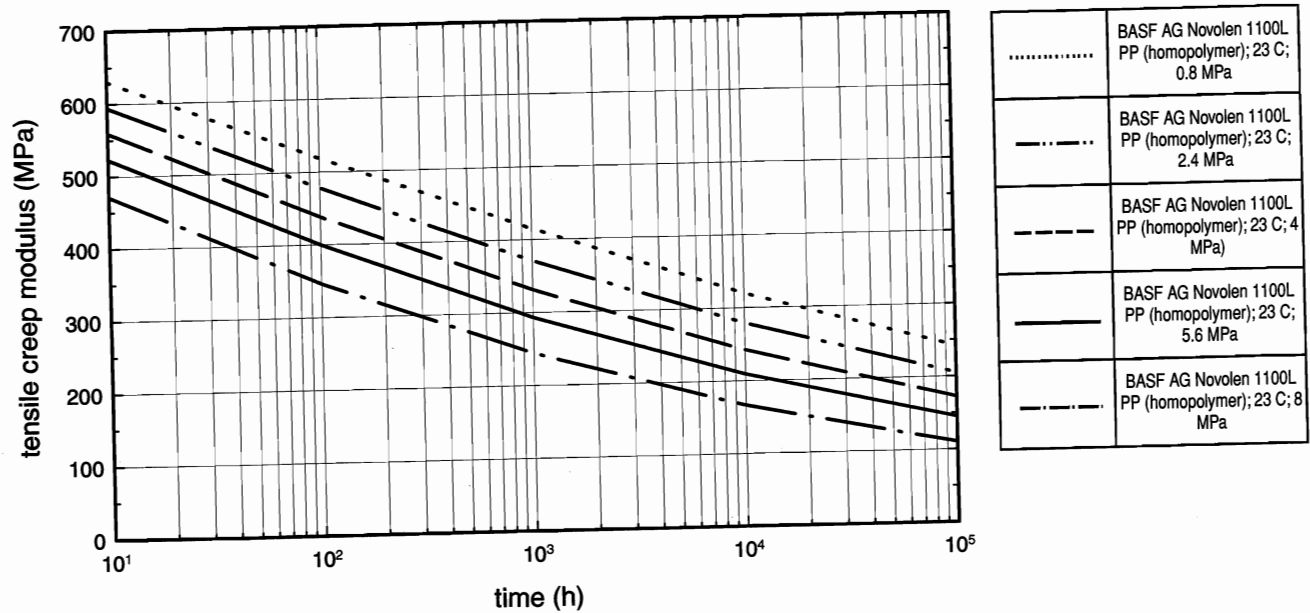
Graph 19.40 Tensile creep strain vs time for Himont Profax polypropylene copolymer.



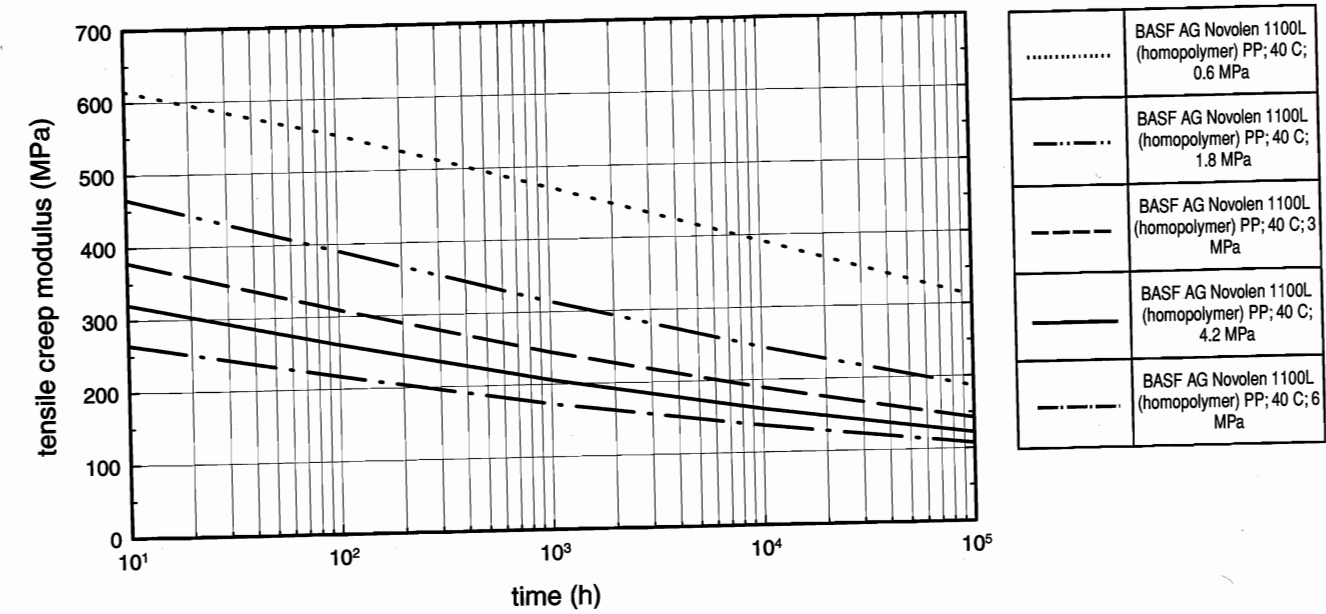
Graph 19.41 Flexural creep strain vs time for LNF Thermocomp MF1008 40% glass reinforced polypropylene.



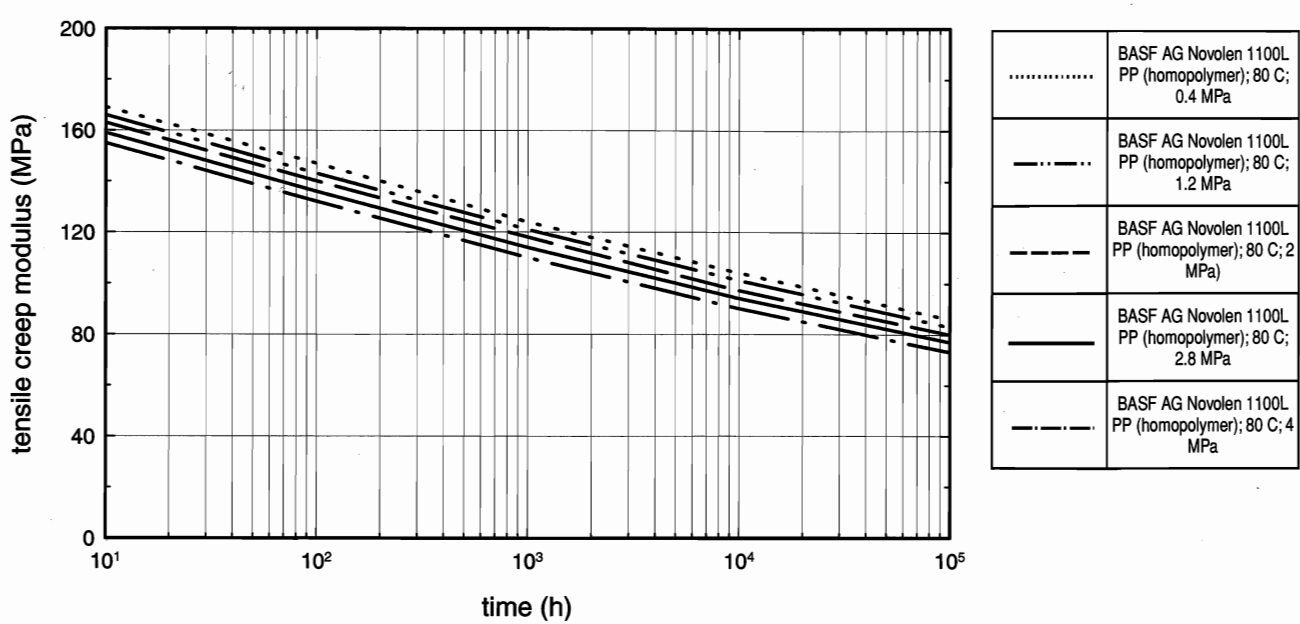
Graph 19.42 Tensile creep modulus vs. time at 23°C for BASF AG Novolen 1100L polypropylene homopolymer.



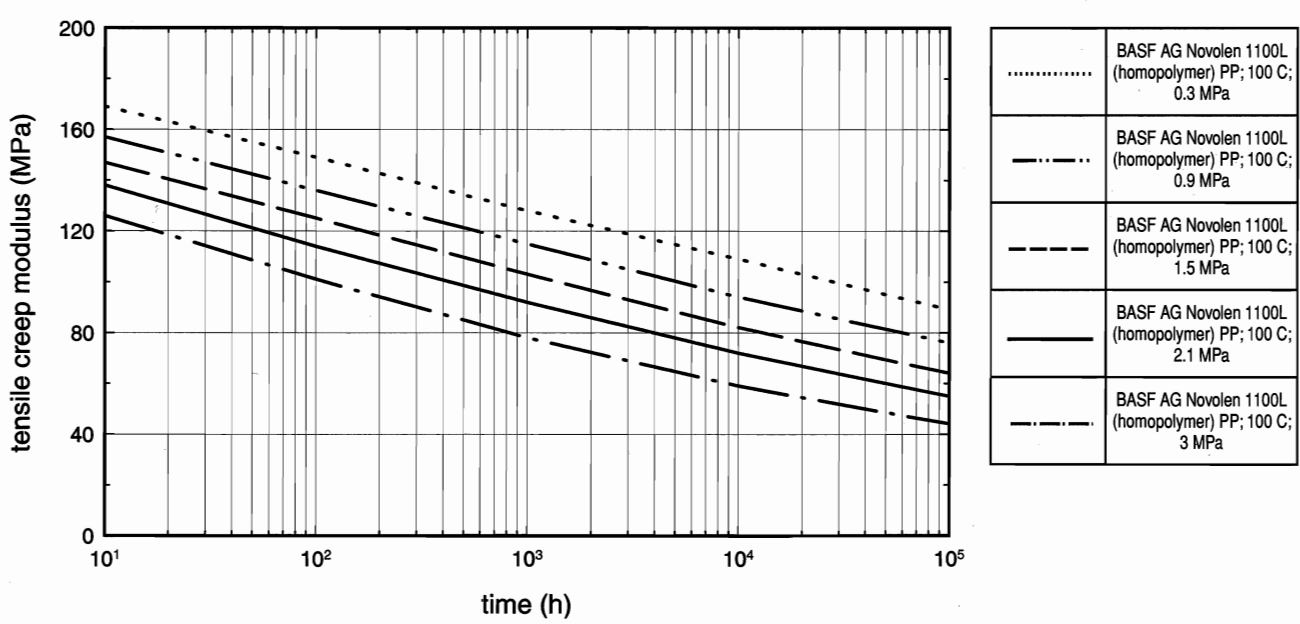
Graph 19.43 Tensile creep modulus vs. time at 40°C for BASF AG Novolen 1100L polypropylene homopolymer.



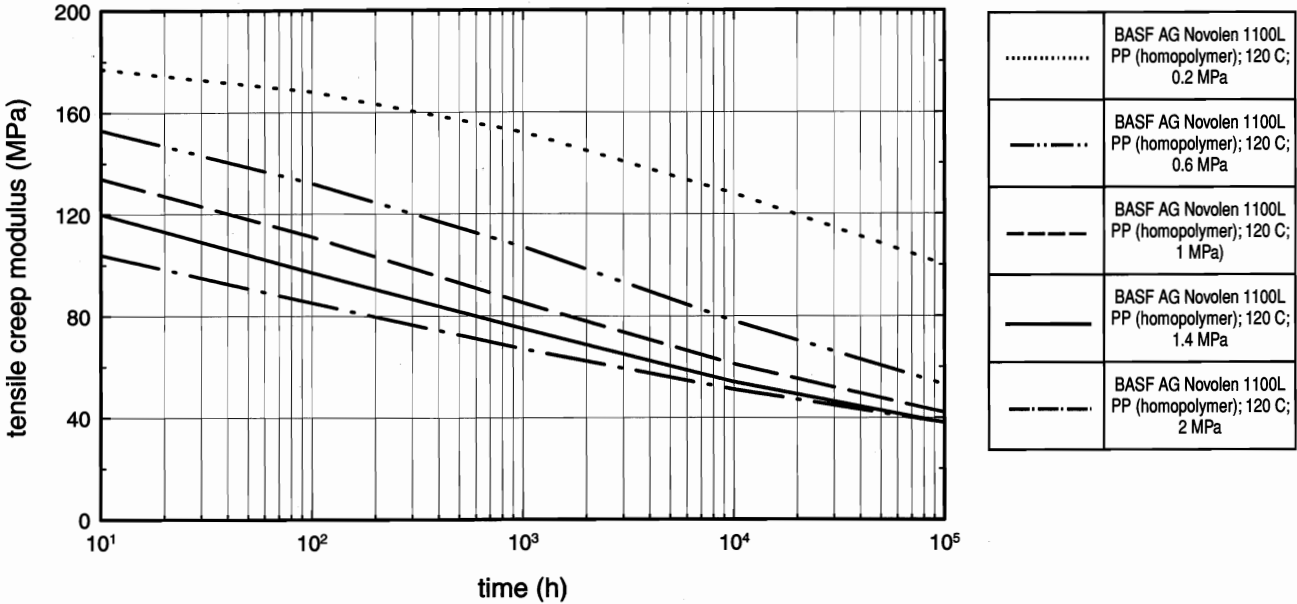
Graph 19.44 Tensile creep modulus vs. time at 80°C for BASF AG Novolen 1100L polypropylene homopolymer.



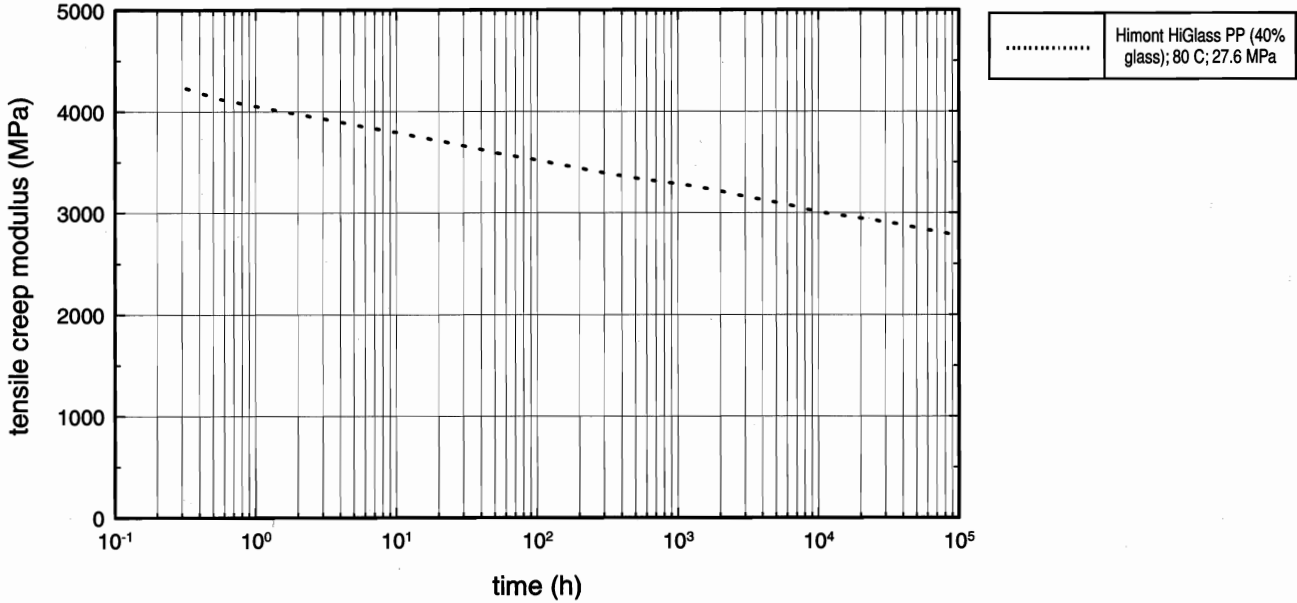
Graph 19.45 Tensile creep modulus vs. time at 100°C for BASF AG Novolen 1100L polypropylene homopolymer.



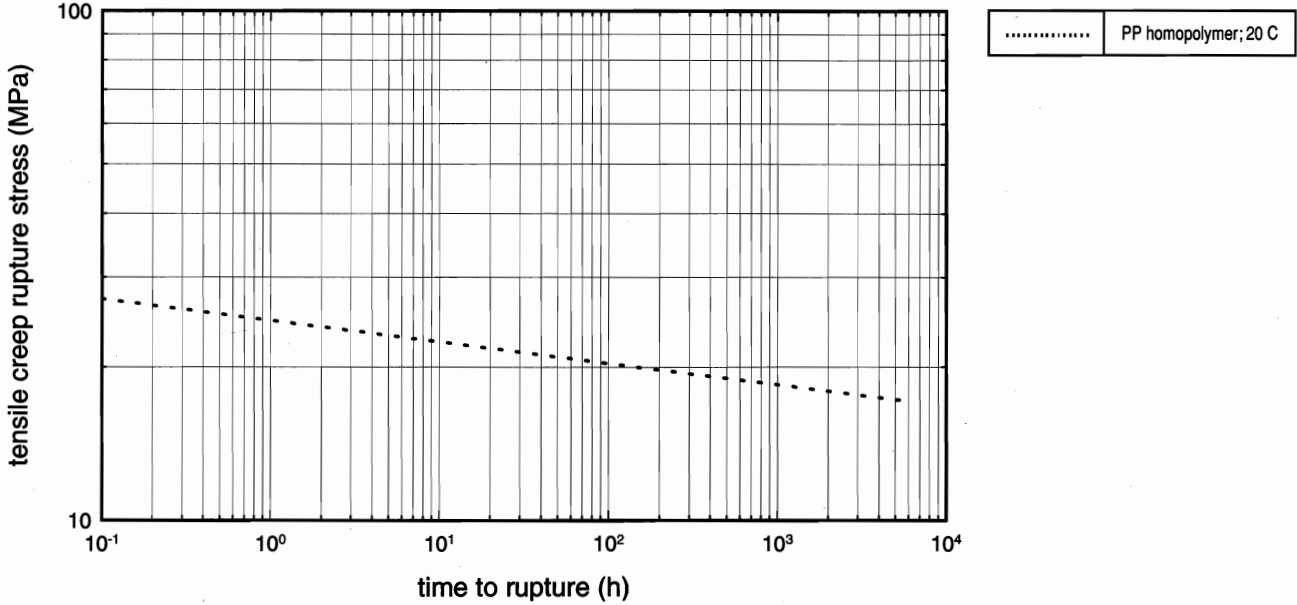
Graph 19.46 Tensile creep modulus vs. time at 120°C for BASF AG Novolen 1100L polypropylene homopolymer.



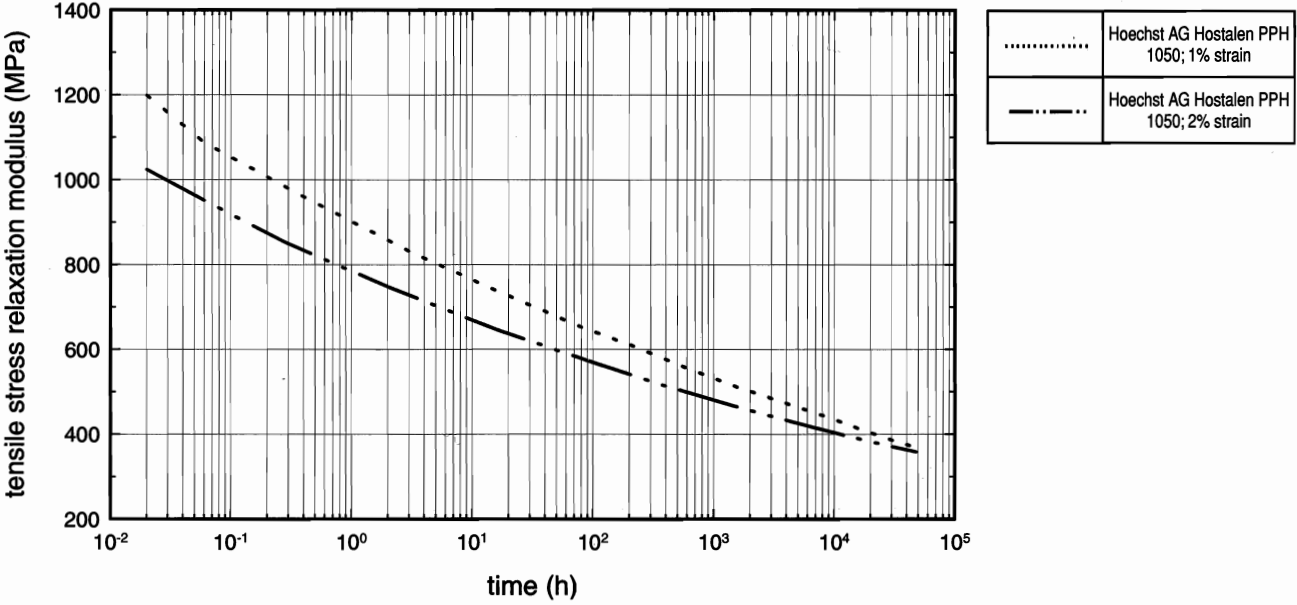
Graph 19.47 Tensile creep modulus vs. time at 80°C and 27.6 MPa for Himont HiGlass 40% glass fiber reinforced polypropylene.



Graph 19.48 Typical tensile creep rupture stress vs time to rupture @ 20°C for polypropylene homopolymer (source: R.Kahl, 1979, paper from Principles of Plastics Materials seminar, Center for Professional Advancement).

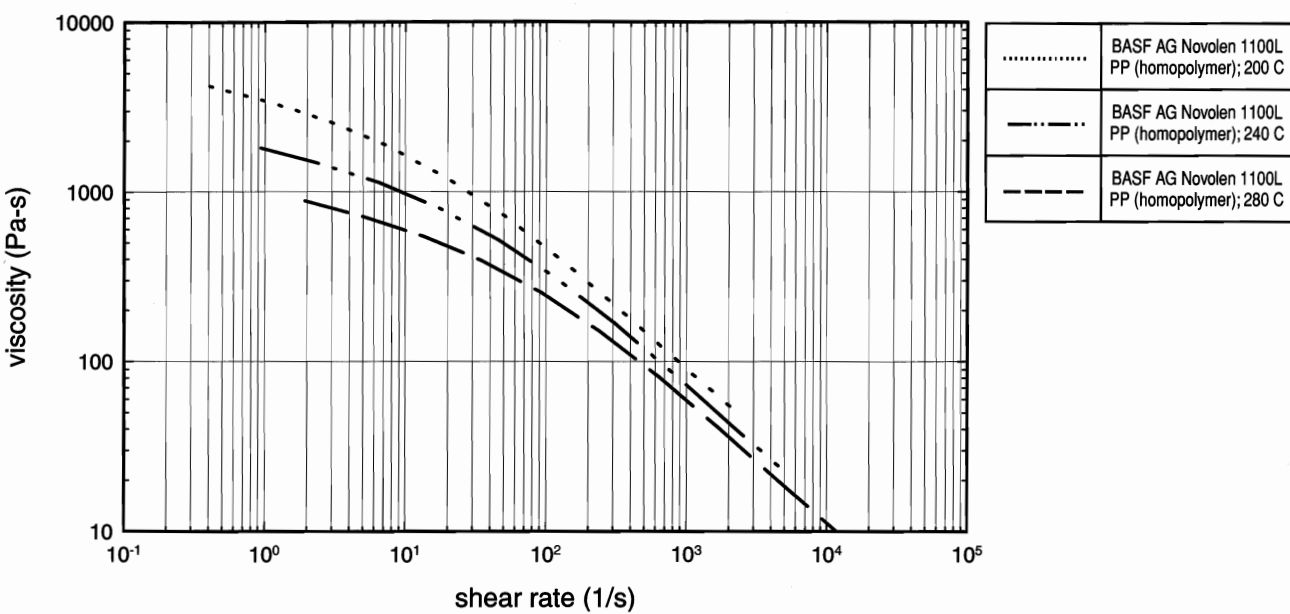


Graph 19.49 Tensile stress relaxation modulus vs time for Hoechst AG Hostalen PPH 1050 polypropylene homopolymer.

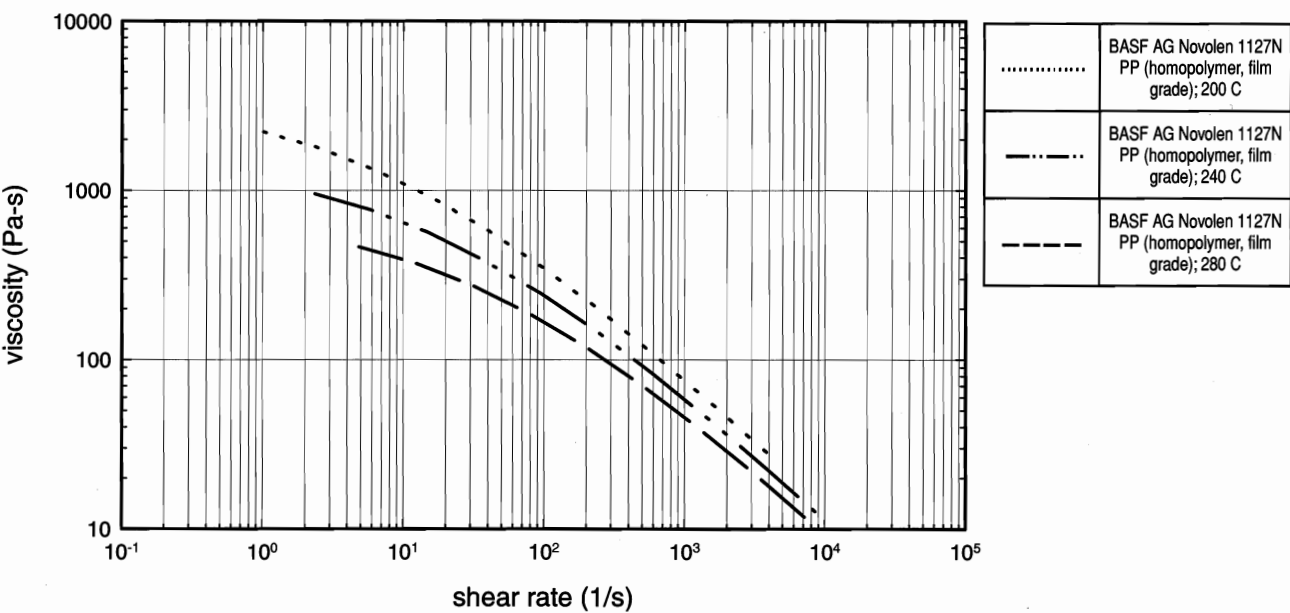


19.8 Viscosity

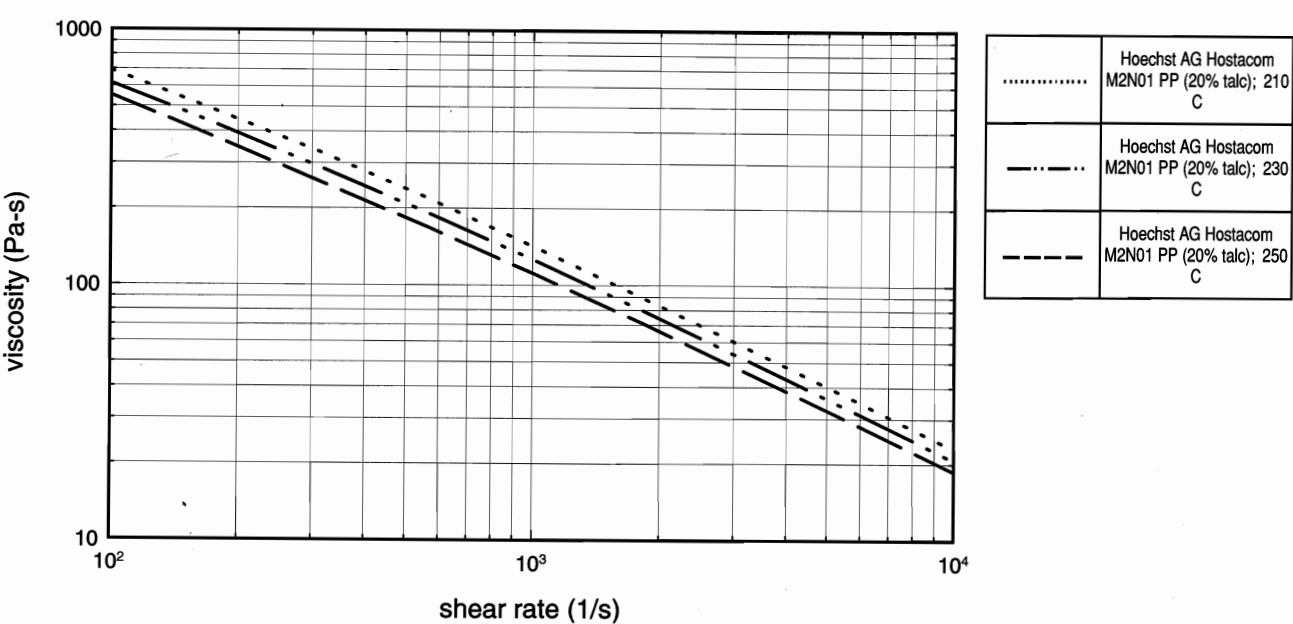
Graph 19.50 Viscosity vs. shear rate for BASF AG Novolen 1100L polypropylene homopolymer.



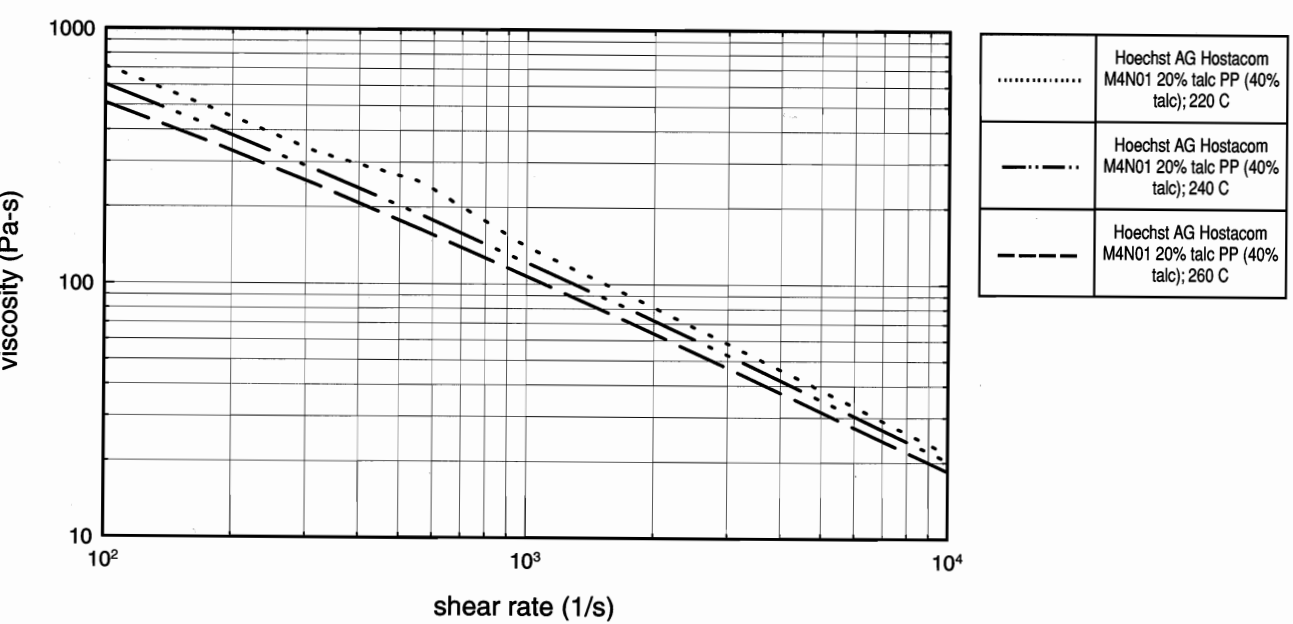
Graph 19.51 Viscosity vs. shear rate for BASF AG Novolen 1127N polypropylene (homopolymer, film grade).



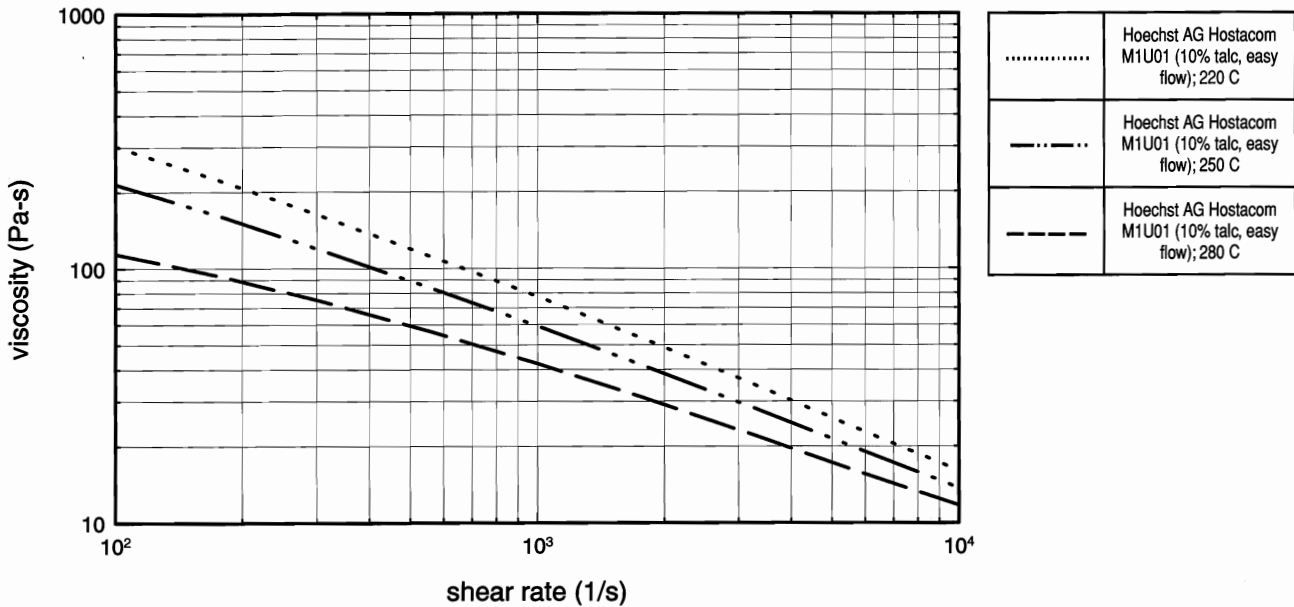
Graph 19.52 Viscosity vs. shear rate for Hoechst AG Hostacom M2N01 20% talc filled polypropylene.



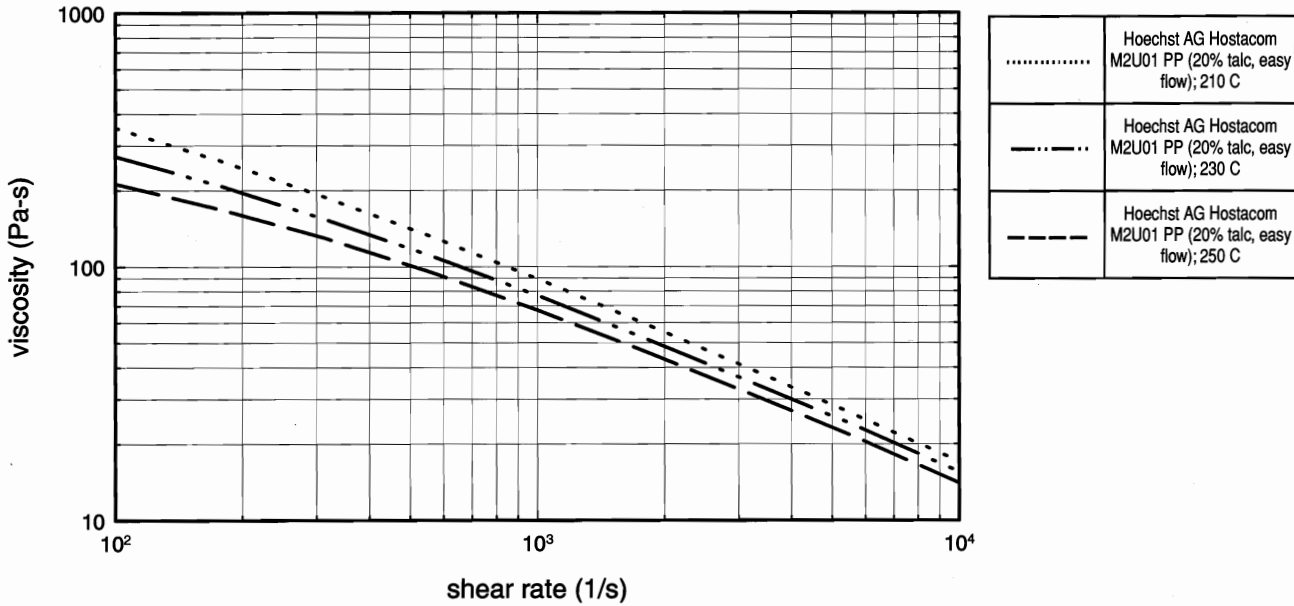
Graph 19.53 Viscosity vs. shear rate for Hoechst AG Hostacom M4N01 40% talc filled polypropylene.



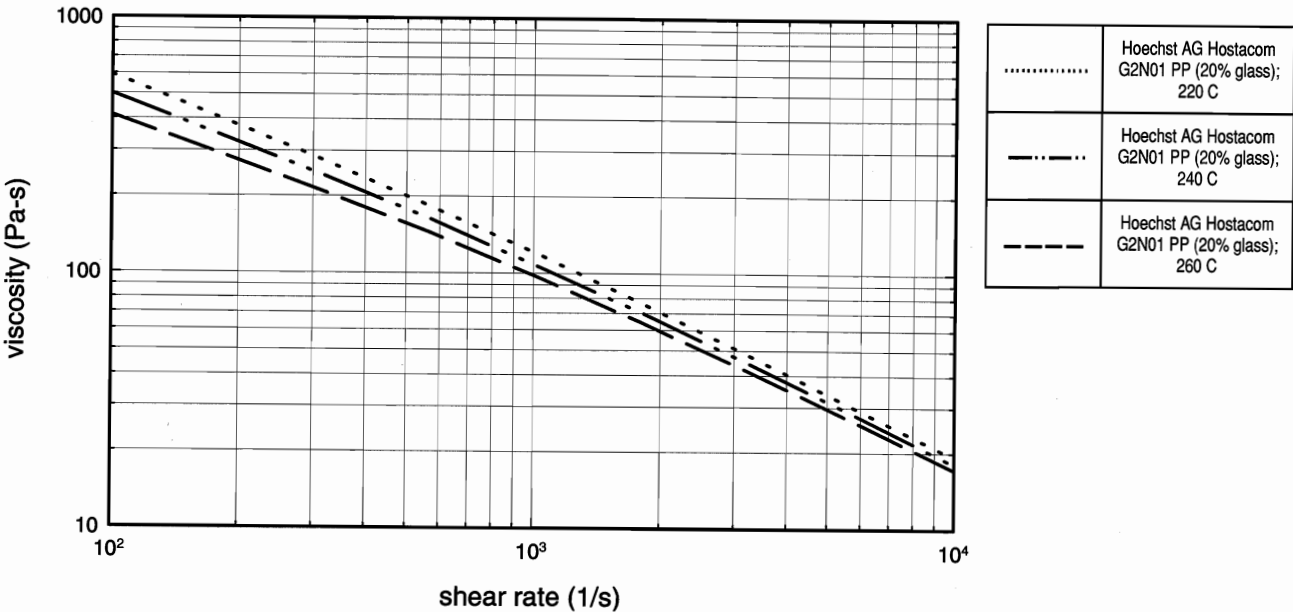
Graph 19.54 Viscosity vs. shear rate for Hoechst AG Hostacom M1U01 10% talc filled polypropylene.



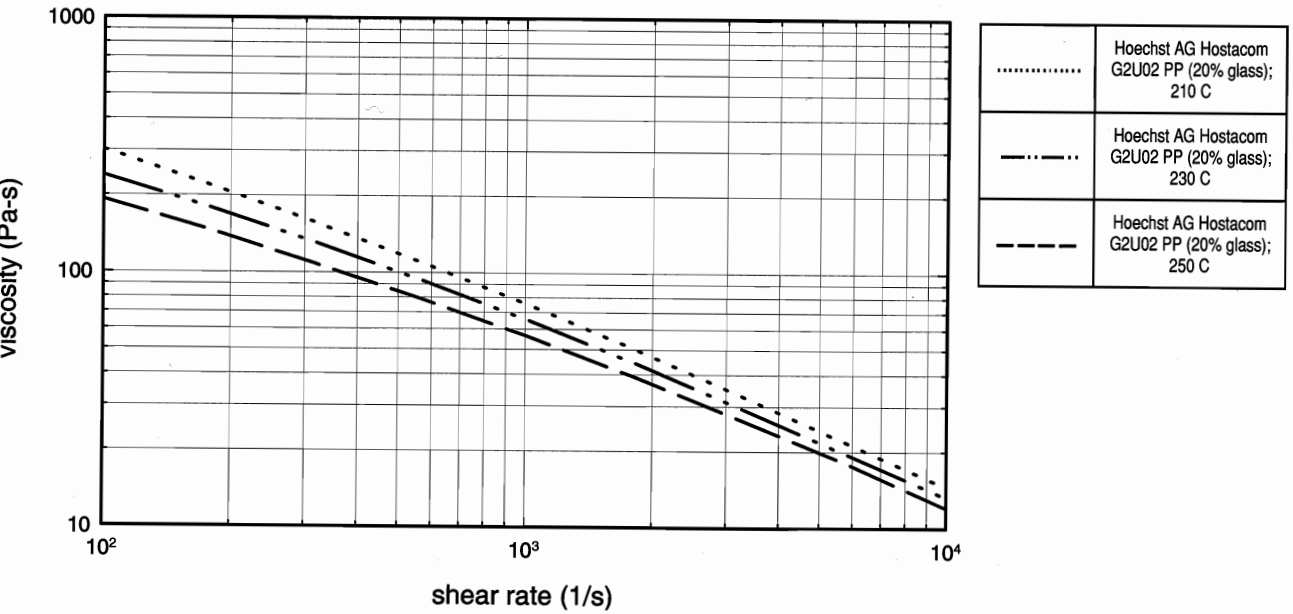
Graph 19.55 Viscosity vs. shear rate for Hoechst AG Hostacom M2U01 20% talc filled polypropylene.



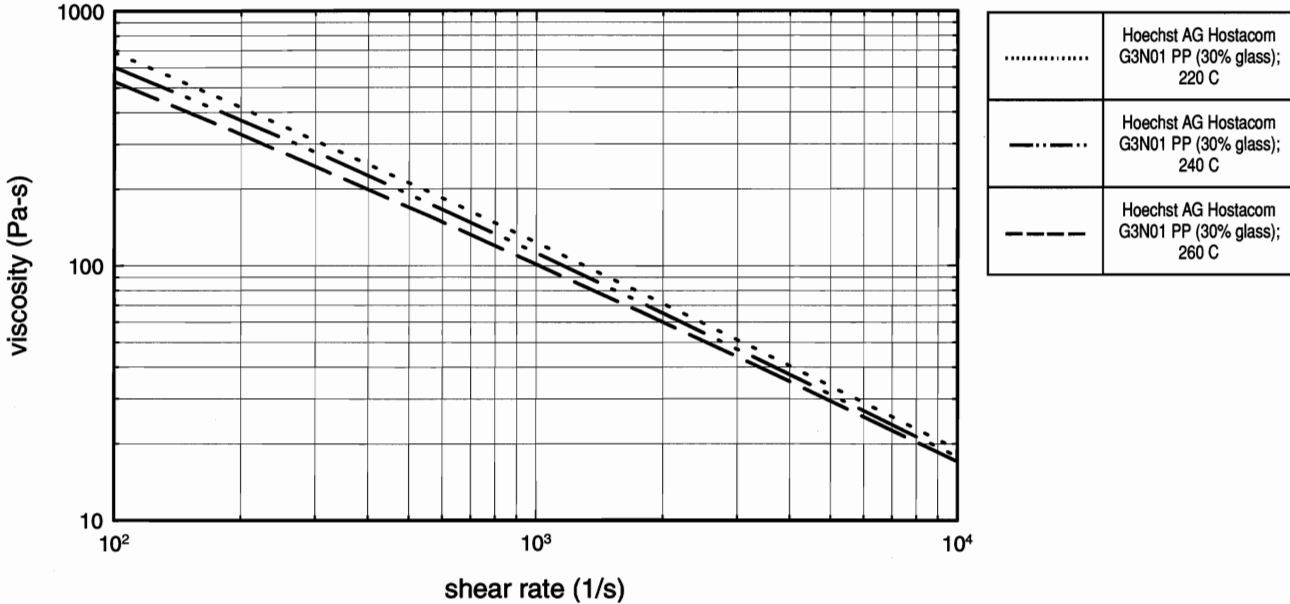
Graph 19.56 Viscosity vs. shear rate for Hoechst AG Hostacom G2N01 20% glass fiber reinforced polypropylene.



Graph 19.57 Viscosity vs. shear rate for Hoechst AG Hostacom G2U02 20% glass fiber reinforced polypropylene.

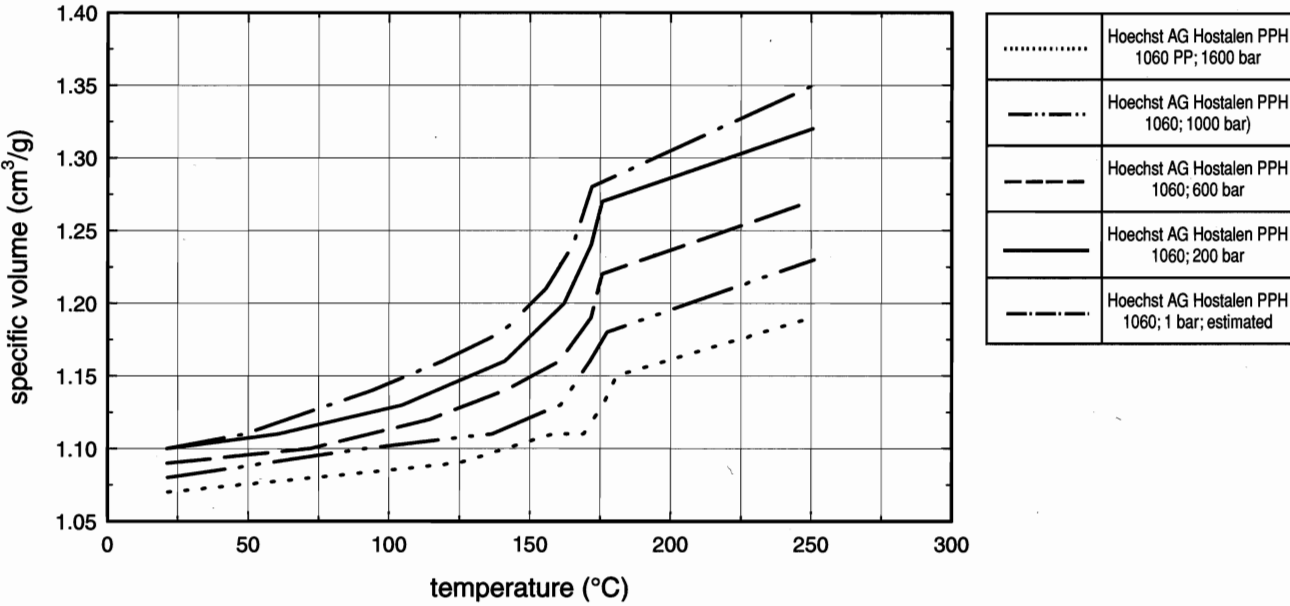


Graph 19.58 Viscosity vs. shear rate for Hoechst AG Hostacom G3N01 30% glass fiber reinforced polypropylene.

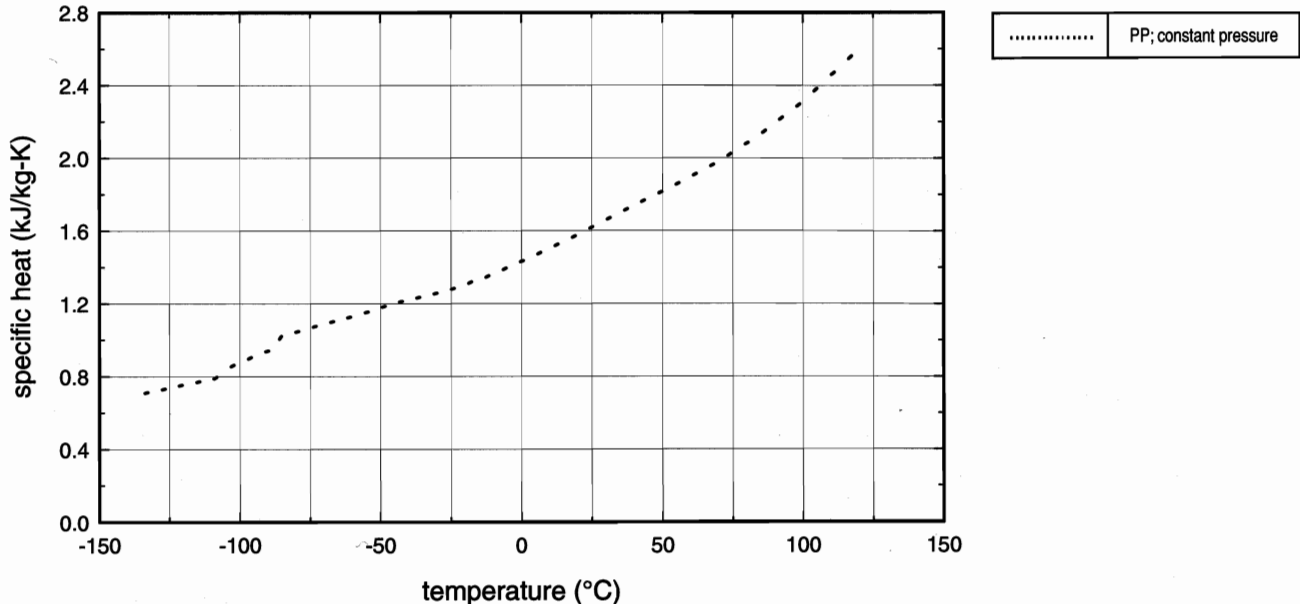


19.9 Thermodynamic Property

Graph 19.59 Specific volume vs temperature for Hoechst AG Hostalen PPH 1060 polypropylene homopolymer. Measured during heating up.



Graph 19.60 Specific heat vs temperature for polypropylene at constant pressure.



Graph 19.61 Enthalpy vs temperature for Hoechst AG Hostacom polypropylene.

