Grivory® G21

Polyamide Copolymer

EMS-GRIVORY

Product Description

Grivory G21 is an amorphous nylon copolymer intended for barrier films and barrier bottles. It complies with 21CFR177.1500 requirements for a nylon 6I/6T in direct contact with all foods except those containing more than 8% alcohol. There are no restrictions on thickness or temperature of use.
Films of Grivory G21 have exceptional oxygen and carbon dioxide barrier properties, even under high humidity conditions. When Grivory G21 is mixed with other nylons, films can be produced with better transparency and gas barrier properties, resulting in long shelf-life for packaged foods. Mixtures of nylon 6 and 15-30% Grivory G21 yield films of good appearance (high gloss), better thermoforming, and higher shrinkage after stretching or thermoforming.
Grivory G21 can also be used to produce transparent bottles by blow molding. These bottles have good gas barrier properties and can be filled at higher temperatures than is possible with polyester (PET) bottles. Grivory G21 can also be used to produce multilayer bottles by multilayer blow molding with PET or polycarbonate, to improve the shelf-life of oxygen sensitive foods and drinks.

General

Material Status	• Commercial: Active		
Availability	• Europe	• North America	
Features	• Amorphous • Barrier Resin	• Copolymer • Food Contact Acceptable	• High Gloss • High Shrinkage
Uses	• Bottles	• Film	
Agency Ratings	• EU 2002/96/EC	• FDA 21 CFR 177.1500	
RoHS Compliance	• RoHS Compliant		
Appearance	• Clear/Transparent		
Forms	• Pellets		
Processing Method	• Blow Molding • Extrusion	• Film Extrusion • Thermoforming	
Multi-Point Data	• Isochronous Stress vs. Strain (ISO 11403-1) • Isothermal Stress vs. Strain (ISO 11403-1)	• Secant Modulus vs. Strain (ISO 11403-1) • Shear Modulus vs. Temperature (ISO 11403-2)	• Specific Volume vs Temperature (ISO 11403-2) • Viscosity vs. Shear Rate (ISO 11403-2)

Physical	Nominal Value	Unit	Test Method
Specific Gravity			
--	1.18	g/cm³	ASTM D792
--	1180	kg/m³	ISO 1183 [2]
Melt Volume-Flow Rate (MVR)			
275°C/10.0 kg	90.0	cm³/10min	ISO 1133
275°C/5.0 kg	20.0	cm³/10min	ISO 1133 [2]
Water Absorption			
24 hr	1.3	%	ASTM D570
Saturation	7.0	%	ISO 62 [2]
Equilibrium	2.0	%	ISO 62 [2]
Viscosity number	105	cm³/g	ISO 307, 1157, 1628 [2]

Mechanical	Nominal Value	Unit	Test Method
Tensile modulus	3000	MPa	ISO 527-2 [2]
Tensile Stress			
Yield	100	MPa	ISO 527-2 [2]
--	72.0	MPa	ASTM D638
Tensile Strain			
Yield	5.0	%	ISO 527-2 [2]
Break	15	%	ASTM D638
Nominal strain at break	> 50	%	ISO 527-2 [2]
Flexural Modulus	2870	MPa	ASTM D790
Flexural Strength	119	MPa	ASTM D790

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Impact	Nominal Value	Unit	Test Method
Charpy notched impact strength			ISO 179/1eA [2]
-30°C	2.00	kJ/m²	
23°C	8.00	kJ/m²	
Charpy impact strength			ISO 179/1eU [2]
-30°C	No Break		
23°C	No Break		
Notched Izod Impact	53.0	J/m	ASTM D256

Hardness	Nominal Value	Unit	Test Method
Durometer Hardness (Shore D)	80		ASTM D2240

Thermal	Nominal Value	Unit	Test Method
Deflection Temperature Under Load			
0.45 MPa, Unannealed	118	°C	ASTM D648
0.45 MPa	115	°C	ISO 75-2 [2]
1.8 MPa, Unannealed	106	°C	ASTM D648
1.8 MPa	105	°C	ISO 75-2 [2]
Glass Transition Temperature			
-- [3]	130	°C	ISO 11357-2 [2]
--	125	°C	DSC
Vicat Softening Temperature			ISO 306 [2]
50°C/h, B (50N)	120	°C	
CLTE			ISO 11359-2 [2]
Flow	0.000060	cm/cm/°C	
Transverse	0.000060	cm/cm/°C	

Electrical	Nominal Value	Unit	Test Method
Surface resistivity	1.0E+13	ohms	IEC 60093 [2]
Volume resistivity	1.0E+12	ohm·m	IEC 60093 [2]
Relative Permittivity			IEC 60250 [2]
100 Hz	3.00		
1 MHz	4.00		
Dissipation Factor			IEC 60250 [2]
100 Hz	0.015		
1 MHz	0.030		
Comparative tracking index	600		IEC 60112 [2]
Electric strength	27	kV/mm	IEC 60243-1 [2]

Flammability	Nominal Value	Unit	Test Method
Burning Behav. at 1.6mm nom. thickn.			ISO 1210 [2]
1.60 mm	V-2		
Burning Behav. at thickness h (0.800 mm)	V-2		ISO 1210 [2]

Optical	Nominal Value	Unit	Test Method
Refractive Index	1.580		ISO 489
Transmittance	91.0	%	ASTM D1003

Additional Information
The value listed as Melt Volume-Flow Rate, ISO 1133, was tested in accordance with DIN 53735. The value listed as Refractive Index, ISO 489, was tested in accordance with DIN 53491. CO2 Permeability, 23°C/0%RH, DIN 53380: 90 cm³/m²/day/bar CO2 Permeability, 23°C/80%RH, DIN 53380: 40 cm³/m²/day/bar Gloss, 60°, DIN 67530: 140 N2 Permeability, 23°C/0%RH, DIN 53380: 10 cm³/m²/day/bar O2 Permeability, 23°C/0%RH, DIN 53380: 30 cm³/m²/day/bar O2 Permeability, 23°C/85%RH, DIN 53380: 10 cm³/m²/day/bar Water Vapor Permeability, 23°C/0%RH, DIN 53122: 7 g/m²/day

Extrusion	Nominal Value	Unit
Drying Temperature	80.0 to 90.0	°C
Drying Time	8.0 to 12	hr
Suggested Max Moisture	0.10	%

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Extrusion	Nominal Value	Unit
Cylinder Zone 1 Temp.	260	°C
Cylinder Zone 2 Temp.	270	°C
Cylinder Zone 3 Temp.	270	°C
Cylinder Zone 4 Temp.	270	°C
Cylinder Zone 5 Temp.	270	°C
Adapter Temperature	270	°C
Die Temperature	270	°C

Extrusion Notes
Dew Point of the Dryer: -25°C The drying conditions listed above are for a desiccant dryer. Vacuum Oven Drying Temperature: 120°C Vacuum Oven Drying Time: 6 to 8 hr

Notes

[1] Typical properties: these are not to be construed as specifications.

[2] Tested in accordance with ISO 10350. 23°C/50%r.h. unless otherwise noted.

[3] 10 °C/min