DuPont™ Kapton® 150PRN411

Polyimide Film

Description

The properties of DuPont™ Kapton® 150PRN411 make it suitable for insulating copper conductor used in high temperature magnet wire applications where improved adhesion between layers and abrasion resistance are desired. Kapton® 150PRN411 polyimide film consists of a layer of 25 micron thick Kapton® HN polyimide film between two layers of high melt temperature fluoropolymer. One of the fluoropolymer layers is approximately ten microns thick and the second layer is approximately three microns thick.

Characteristics

- High performance adhesive system
- Advanced abrasion resistance
- High temperature, >240°C
- Reliable thermal durability
- Chemical resistance

Applications

- Magnet wire
- ESP motors
- Traction motors: rail, auto, & mining
- Industrial motor insulation
- Wind & hydro generators

Processing Suggestions:

Recommended Overlap

Laboratory test results indicate that improved mechanical performance can be achieved by using a positive overlap (51 to 66% overlap). The overlap that is used should be consistent with the dielectric properties that are needed for the insulation.

Applying Material to the Conductor

The modulus of elasticity (i.e. stiffness) of the polyimide film used to produce the PRN product is the same as the modulus of the polyimide film used to produce the Kapton® FN products. The surface characteristics of the PRN material are different than the surface properties of the FN products. These surface differences will result in less friction between the insulation tape and the taping machine components. This difference in friction properties may require taping machine adjustments be made to properly apply the tape to the conductor (ex. clutch adjustments, etc.).

Fusing the Tape to the Conductor

The PRN material is an unbalanced composite structure with a Kapton® polyimide core that is covered with fluoropolymer on both sides. The type of fluoropolymer that is used in each of the layers is tailored to yield the best wire insulation properties. The fluoropolymer on one side of the film is designed to have good fusing properties while the fluoropolymer on the opposite side of the film is designed to have enhanced mechanical abrasion resistance. The two fluoropolymer layers have been tinted with a small amount of pigment so that they can be easily differentiated. The abrasion resistant layer has been tinted to have a tan color and the high adhesion layer has been tinted red. It is recommended that red side of the tape be oriented toward the copper for most magnet wire applications.

Both the abrasion resistant layer and the adhesive layer have been made using fluoropolymer that are more thermally stable and have higher melt points than the fluoropolymer used in the Kapton® FN and FWN products. As a result the process temperature that is required to fuse the tape layers to each other and to fuse the tape to the conductor will be higher than the temperature needed to fuse the FN and FWN materials. Laboratory tests indicate that to achieve good adhesion between the insulation and the conductor, the conductor and the insulation temperature must be at least 340±5°C.

Handling Wire Insulated with 150PRN411

The outer surfaces of 150PRN411 become soft when they are heated near their melt point. While they are at this elevated temperature the outer fluoropolymer surface can be easily marred by coming in contact with foreign objects. The use of nip rolls on the wire during the manufacturing process, while near the fusing temperature of the fluoropolymer, is not recommended.

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Table 1. Typical Physical Properties of DuPont™ Kapton® 150PRN411 Polyimide Film

Property	Units	Typical Value	Test Method
Thickness	mil	1.5	ASTM D374
	µm	38	
Tensile Strength	kpsi	27	ASTM D882
	MPa	186	
Elongation	%	88	ASTM D882
Tensile Modulus	kpsi	310	ASTM D882
	GPa	2.14	
Dielectric Strength	V/mil	5400	ASTM D149
	kV/mm	212	
350°C Heat Seal Strength (F to Cu)	gms/in	930	DuPont Test Method
	gms/cm	366	
Yield	ft^2/lb	78.4	–
	m^2/kg	16	
Density	g/cc	1.68	ASTM D1505
Results Below - polyimide film data only			
Dielectric Constant @ 1 kHz	–	3.4	ASTM D150
Dissipation Factor @ 1 kHz	–	0.002	ASTM D150
Volume Resistivity	ohm-cm	$>10^{16}$	ASTM D257
UL Electrical RTI	°C	240	UL 746B
UL Mechanical RTI	°C	200	UL 746B
Flammability	UL-94	V-0	UL Test Method

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For more information on DuPont™ Kapton® polyimide films or other DuPont products, please visit our website.

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