

DuPont Flexible Substrates for Thin Films BIPV and Concentrator PV

DUPONT™ KAPTON® POLYIMIDE FILMS

Improved process robustness and superior performance



Introduction

DuPont™ Kapton® is a premium performance polyimide film widely used as a dielectric substrate for flexible printed circuits and high density interconnects. The high temperature resistance, non-burn/smoke characteristics, toughness and flexibility of Kapton® have proven reliable for electrical as well as non-electrical applications. Kapton® has more than 40 years of proven performance as the material of choice in applications involving temperature extremes and harsh environments.

Photovoltaic Applications

DuPont™ Kapton® polyimide films are in commercial use as well as in evaluation for substrates in Thin Film a-Si modules and CIGS applications, where the stiffness and dimensional stability at elevated deposition temperatures are critical to producing cells with maximum efficiency and yields. The low CTE of Kapton® E and EN-L polyimide films minimizes the stress at the interface both during processing and end use temperature extremes.

Kapton® Gage/Type	200H	200E	200EN-L
Modulus MD @50C [GPa]	2.4	6.3	5.9
Modulus MD @480C [GPa]	0.2	<0.1	0.4
avg CTE [ppm/°C] MD/TD(50-350°C)	29	16	11
Tg [DMA, tan δ, °C]	402	355	372
Slip Additive	N	N	Y

The **Concentrator PV** market is turning to special performance Kapton® as the primary dielectric where harsh conditions and temperature extremes are imposed by >20 suns. Kapton® MT has 3X both the thermal conductivity and cut-through strength of standard polyimides while not sacrificing physical or electrical properties. Kapton® MT and other filled versions bond well with a variety of adhesives including DuPont™ Pyralux® or DuPont™ PV Encapsulants.

Properties	Kapton® MT
Thermal Conductivity	0.45 W/m-K
Dielectric Strength	5000 volts/mil
Elongation	80%
Cut Through	40 lbs
Modulus	3.2 GPa

Next Generation Developments

Flexible substrates and systems providing even higher temperature capability for CIGS and complementary ultra low moisture barrier film top sheet are under development. When flexibility and space/weight savings are key (ie-BIPV applications), DuPont™ Kapton® thin film substrates and PV laminate systems offer advantages not seen with typical larger, heavier constructions and is key for the high growth Building Integrated PV market. The combination of Kapton® with low moisture ingress DuPont™ PV Encapsulants and the ultra moisture barrier film top sheet under development will allow for greater design freedom in the growing arena of flexible thin film and concentrator photovoltaic modules.

For more information about Kapton® or other DuPont Photovoltaic Solutions:

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photovoltaics.dupont.com

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Caution: Do not use in medical applications involving permanent implantation in the human body. For other medical applications, see "DuPont Medical Caution Statement, H-51459 or H-50102-2"



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