

Allyl pentafluorobenzene(abb.APFB)



Purity	98%
CAS Number	1736-60-3
Molecular Formula	C ₉ H ₅ F ₅
Molecular Weight	208.13

Polyimides are widely used insulating materials in microelectronics, but with the rapid increase in information content, there is a strong demand for the insulating material; PI (currently 3wt%) has a low dielectric constant ($\epsilon=3.5 \rightarrow 2.8$ or less) and low hygroscopicity. Fluorinated PI and fluororesin were also considered, but due to cost and processability, they have not been widely used. Plasma treatment of the PI surface with a fluorine compound has also been considered, but none of these methods have shown satisfactory properties. The plasma polymerization (abb.;pp-) of APFB(mixture with Ar) on PI film was investigated in detail. It showed good in the adhesion with PI, heat resistance (250°C*2hr), and water repellency, expected low ϵ coating film with fluorine contents equivalent to that of pentafluorostyrene (abb.:PFSt, dielectric constant $\epsilon=2.0$) with irradiating energy at 100W. It also showed much better heat resistance than PFSt.

Table-1 Surface composition of pp-APFB on PI film(XPS)

RF power	APFB/Ar		APFB/H ₂		APFB/N ₂		APFB/O ₂	
	F/C	O/C	F/C	O/C	F/C	O/C	F/C	O/C
5W	0.53	0.01	0.52	0.05	0.52	0.04	0.41	0.22
35W	0.51	0.02	0.51	0.04	0.44	0.06	0.35	0.27
70W	0.51	0.02	0.50	0.03	0.44	0.08	0.30	0.32
100W	0.50	0.04	0.45	0.04	0.43	0.04	0.29	0.30
150W	0.50	0.03	0.43	0.05	0.44	0.04	0.27	0.27

It is assumed that the fluorine in the aromatic ring of both pp-APFB and pp-PFSt is relatively susceptible to decomposition under plasma, causing reactions with other elements and cross-linking reactions, which create surface irregularities and a porous structure (AFM).

Table-2 Advancing and receding water contact angle

Surfaces	Advance angle(°)	Receding angle(°)
PTFE film	111	77
PI film(Kapton HN)	53	31
PI film(Kapton FN)	71	37
Ar pp-APFB (5W)	84	52
Ar pp-APFB (100W)	174	135

Polymer, 43, 2002, p7279-7288, J. Mater. Chem. 2002, 12, p426-431, J. Applied Physics, 1998, 84, p439-444

Properties:

Appearance	Liquid
Boiling point, °C	149-150