

## Welcome to the World of Base Materials

*Flexible base materials*

*Semi-flexible base materials*

*Coverlay films, bonding films, adhesive prepregs*

*Adhesive-coated materials*



# AKAFLEX®: Successful solutions for flexible printed circuits

AKAFLEX® is an all-inclusive product family of flexible and semi-flexible base materials, coverlay films, bonding films and adhesive prepregs. The materials are ideally suited for making flexible printed circuits, and the products are characterised by advantages which prove to be crucial:

■ AKAFLEX® is environmentally-friendly because the adhesives used are halogen-free, ROHS requirements are fulfilled and constancy in product quality per ISO 9001, ISO/TS 16949 and IPC norms is assured. Supplied on reels or ready-formatted.

■ AKAFLEX® laminates provide the right solution for each technical and economic requirement from the individual selection of metal foil and backing material used. These laminates can be processed by all common production techniques used in manufacturing flexible circuits.

■ AKAFLEX® coverlay films are manufactured from all laminate substrates in a variety of thickness grades. The adhesive-bonding systems available make laminating possible both by hot-pressing and the reel-to-reel method.

## The components

### Backing film

The dielectrics most commonly used for flexible printed circuits (FPC) are polyethyleneterephthalate (PET), polyethylenenaphthalate (PEN), polyetherimide (PEI) and polyimide (PI). Differing values for the major properties are primarily attributable to the characteristic differences in polymer structure.

#### Polymer properties

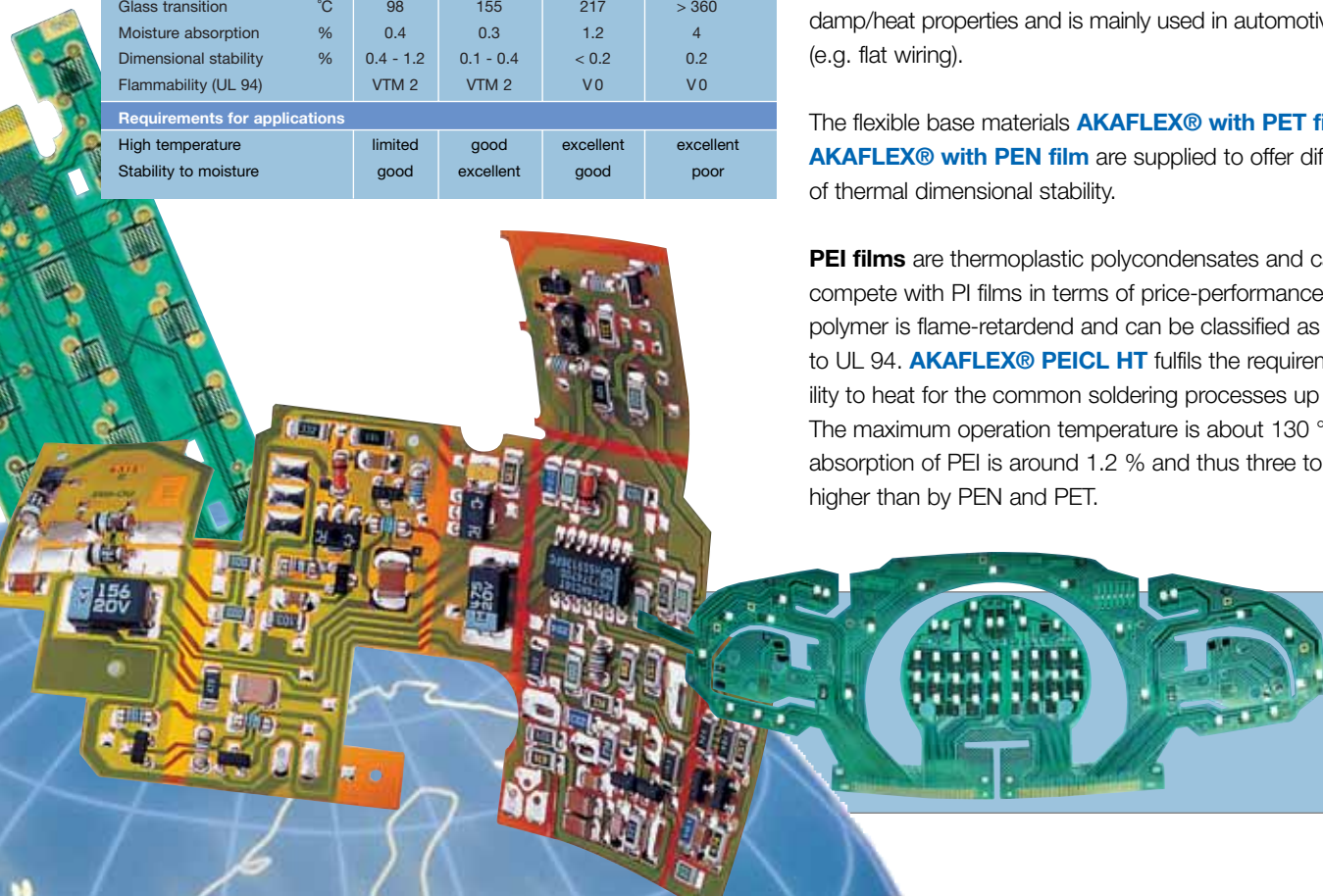
Polymer	PET	PEN	PEI	PI
Type	thermoplastic			thermoset
Melting point	250 °C	265	> 320	none
Degradation	-	-	-	> 400
Glass transition	98 °C	155	217	> 360
Moisture absorption	0.4 %	0.3	1.2	4
Dimensional stability	0.4 - 1.2 %	0.1 - 0.4	< 0.2	0.2
Flammability (UL 94)	VTM 2	VTM 2	V0	V0
<b>Requirements for applications</b>				
High temperature	limited	good	excellent	excellent
Stability to moisture	good	excellent	good	poor

**PET films** are used for low-temperature applications. **AKAFLEX® PCL HT** is a modified copper clad laminate (CCL) designed for maximum operation temperatures (MOT) of 110 °C. Taking into account the low melting temperature, only selective-soldering procedures (laser-soldering, manual soldering) can be recommended here. In all cases where greater stability to moistures is called for – like for example in diverse automotive applications – **AKAFLEX® PCL FW** is the preferred alternative.

Due to the polymer structure, **PEN films** have a melting temperature which is about 15 °C higher than for PET films. This permits peak reflow-temperatures of 250 °C when processing **AKAFLEX® PENCL HT**. **AKAFLEX® PENCL FW** is characterised by better damp/heat properties and is mainly used in automotive applications (e.g. flat wiring).

The flexible base materials **AKAFLEX® with PET film** and **AKAFLEX® with PEN film** are supplied to offer differing degrees of thermal dimensional stability.

**PEI films** are thermoplastic polycondensates and can certainly compete with PI films in terms of price-performance ratio. The polymer is flame-retardant and can be classified as V0 according to UL 94. **AKAFLEX® PEICL HT** fulfils the requirements for stability to heat for the common soldering processes up to 288 °C. The maximum operation temperature is about 130 °C. The water absorption of PEI is around 1.2 % and thus three to four times higher than by PEN and PET.





Copper clad laminate



Laminating machinery in the clean room

**PI films** are thermosetting polymers. There is no melting point. The structure starts to change and undergo degradation only at around 400 °C. The outstanding thermal properties and the excellent chemical stability are mutually supplementing in an ideal manner. PI is not flammable and is classified according to UL 94 as a V0 plastic. With **AKAFLEX® KCL HT** the epoxy-resin adhesive system has been matched to the unique properties of the PI film to an optimum, thereby making a maximum operation temperature of 150 °C possible.

On account of the good chemical stability and the low shrinkage, **AKAFLEX® KCL HT** is the copper laminate most suitable for flexible and rigid-flexible circuits as well as flexible multi-layers. There are a number of advantages, especially in plated through-hole processes. The desmearing can easily be accomplished with potassium permanganate or sodium permanganate. Plasma etching which is typical for acrylic systems is not necessary. The high water absorption of PI of about 4% has to be accordingly taken into account for all working steps where the temperature is above 200 °C. This is the reason why pre-drying for one hour at 120 °C is recommended.

#### Fibre-reinforced backing materials

Plastic films cannot be used in certain applications because the tear strength is too low, the moisture absorption is too high or thermal shrinking is excessive. In such situations, our fibre-reinforced semi-flexible variants **AKAFLEX® GHE, AKAFLEX® HPCL and AKAFLEX® PGCL** are available as proven engineering alternatives. These can be processed in the same way as their standard counterparts.

#### Metals

**AKAFLEX® metal laminates** are made to specification with copper (electrolytic deposited, rolled, rolled and annealed), aluminium, resistance alloys or stainless steel.

#### Adhesive-coated materials

We also supply adhesive-coated materials. The materials can be processed in the cold condition at room temperature and be coated onto plastic films, fibre-reinforced substrates, as well as onto the back of copper laminates – exactly as requested by the customer.

#### Product range of metal laminates, coverlay films, bonding films

	AKAFLEX®	Dielectric substrate		Conductive layer		Modified epoxy adhesive		
		Polymer	Thickness [µm]	Metal	Thickness [µm]	Crosslinking grade	Thickness [µm]	
CCL Copper clad laminate	PCL	PET	25-50-75-100-125	copper (ED, RA)	5-12-17-35-70-105	C-stage	15	
	PENCL	PEN	25-50-75					
	PEICL	PEI	25-50					
	KCL	PI	12-25-50-75-125					
CL Coverlay	GHE, HPCL, PGCL	EP (fibre-reinforced)	70-100-110-140-180			B-stage	15-25-50	
		PDF	PET					25-50-75-100-125
		PENDF	PEN					25-50-75
		PEIDF	PEI					25-50
		KDF	PI					12-25-50-75-125
BP Bondply	CDF HPDF	epoxy cast film	–			B-stage	25	
		EP (fibre-reinforced) + adhesive	70-100					



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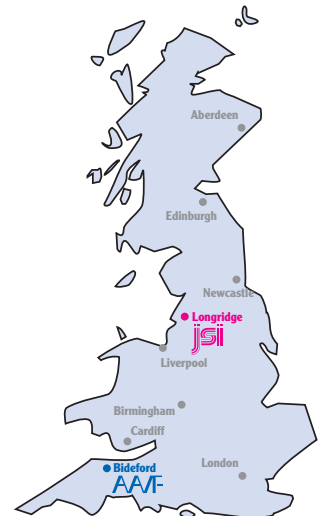
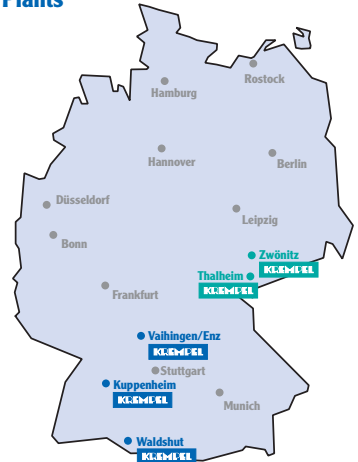


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