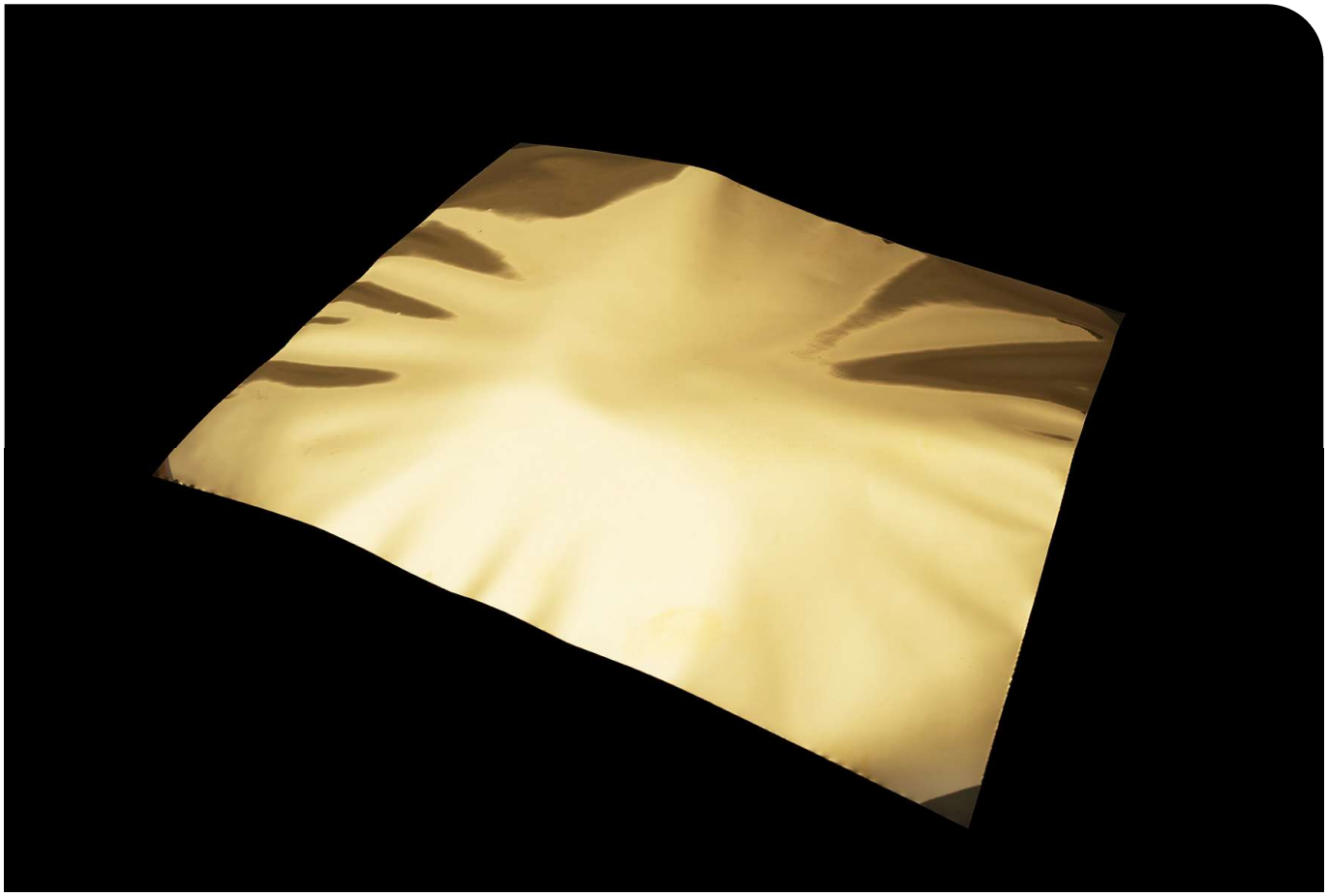
PRECISION ACOUSTICS

PVdF piezo-electric film



Precision Acoustics Ltd are pleased to announce the re-introduction of their range of PVdF piezo-electric film. This PVDF homopolymer is available in three different thicknesses and can be supplied with or without metallised electrodes.

Quarter and half wave thickness resonance frequencies for PVdF film can be deduced from the acoustic velocity and the thickness of the film.

There may be some localised variation in properties and therefore all data within this document are provided as indicative values and cannot be guaranteed.

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AVAILABLE FILM CONFIGURATIONS

Nominal thickness [µm]	Orientation
28, 40 or 80	Uni-axially stretched

EVAPORATED ELECTRODE OPTIONS

Film is usually coated with 250 nm Gold (Au) electrodes on top of 50 nm Chrome (Cr) keying layer but can be supplied without evaporated electrodes (on request).

SHEET DIMENSIONS

- PVdF piezo-electric film with evaporated electrodes is available in sheets of 170 mm by 180 mm.
- PVdF piezo-electric film without electrodes is available in any length and width up to 350 mm.

BASIC INFORMATION

PVdF is a semi-crystalline polymer consisting of micro-crystallites within amorphous polymer chains.

Acoustical properties				
Longitudinal wave speed	c_L	2200 m/s (± 50 m/s)		
Shear wave speed	c_S	1085 m/s		
Density	ρ	1780 kg/m^3		
Thermal properties				
Melting temperature	T_m	175 °C		
Curie temperature	T_C	205 °C		
Maximum usable temperature	T_{max}	70 °C		
Glass transition temperature	T_g	-42 °C		
Volume specific heat		2.5 J/(cm^3 °C)		
Thermal conductivity	K	0.13 W/(m °C)		
Thermal diffusivity	α	0.053 mm^2/s		
Electrical properties				
Coercive field strength	E_c	110 MV/m		
Breakdown field strength	E_B	150-200 MV/m		
Volume resistivity		>10^{14} Ω m		
Di-electric constant, loss	ε_r, tan(δ)	See Figure 1 and Figure 2 below		
Elastic constants			28 µm	40 µm, 80 µm
	C_{33}^D		8.2 GPa	9.0 GPa
	C_{33}^E		8.1 GPa	8.6 GPa
Piezoelectric constants				
	k_t		0.12	0.145
	d_{31}	Quasi-static:	14.5 pC/N	27 pC/N
	d_{32}	Quasi-static:	2.2 pC/N	5 pC/N
	d_{33}	Quasi-static: 10 MHz to 20 MHz:	-14.5 pC/N -23.8 pC/N	-19.1 pC/N, -25.5 pC/N
Optical properties				
Refractive index	n	1.42		
Beta : Alpha phase ratio		~ 80% (determined by FTIR)		

DI-ELECTRIC CONSTANT

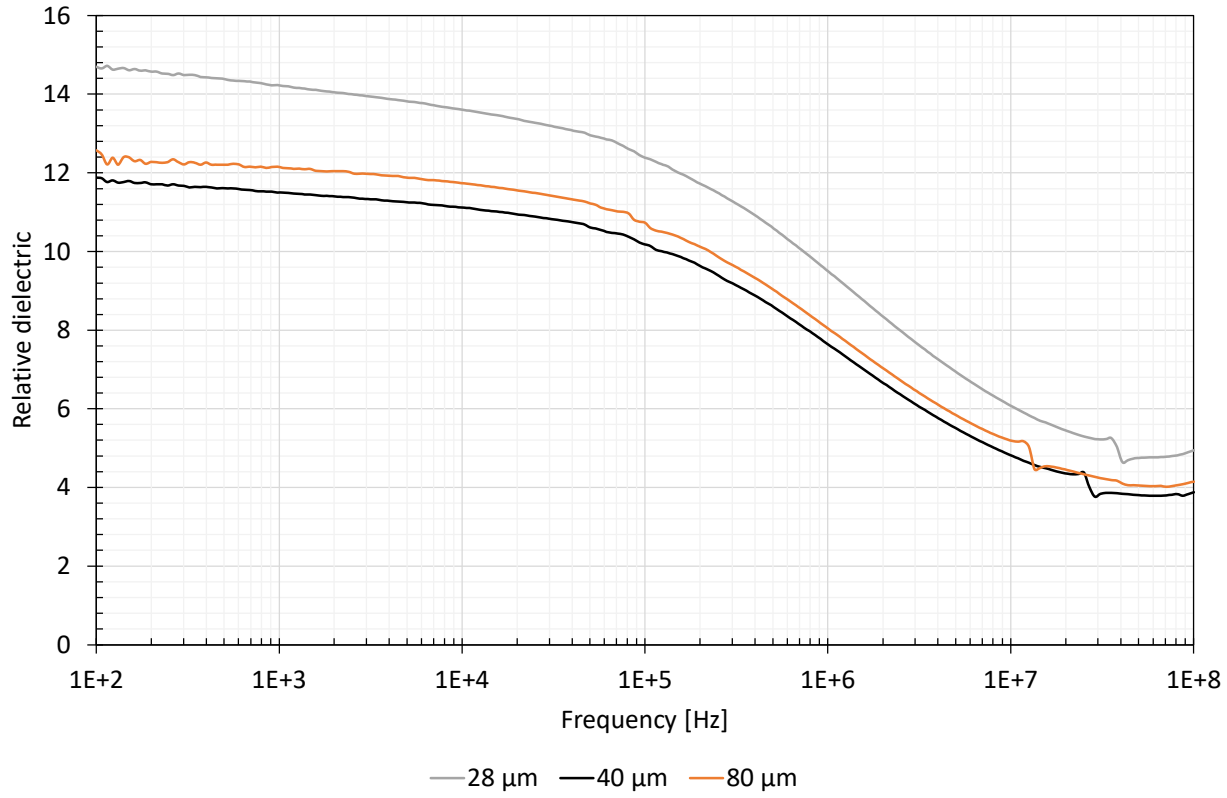

Figure 1 - Dielectric constant of PVDF as a function of frequency

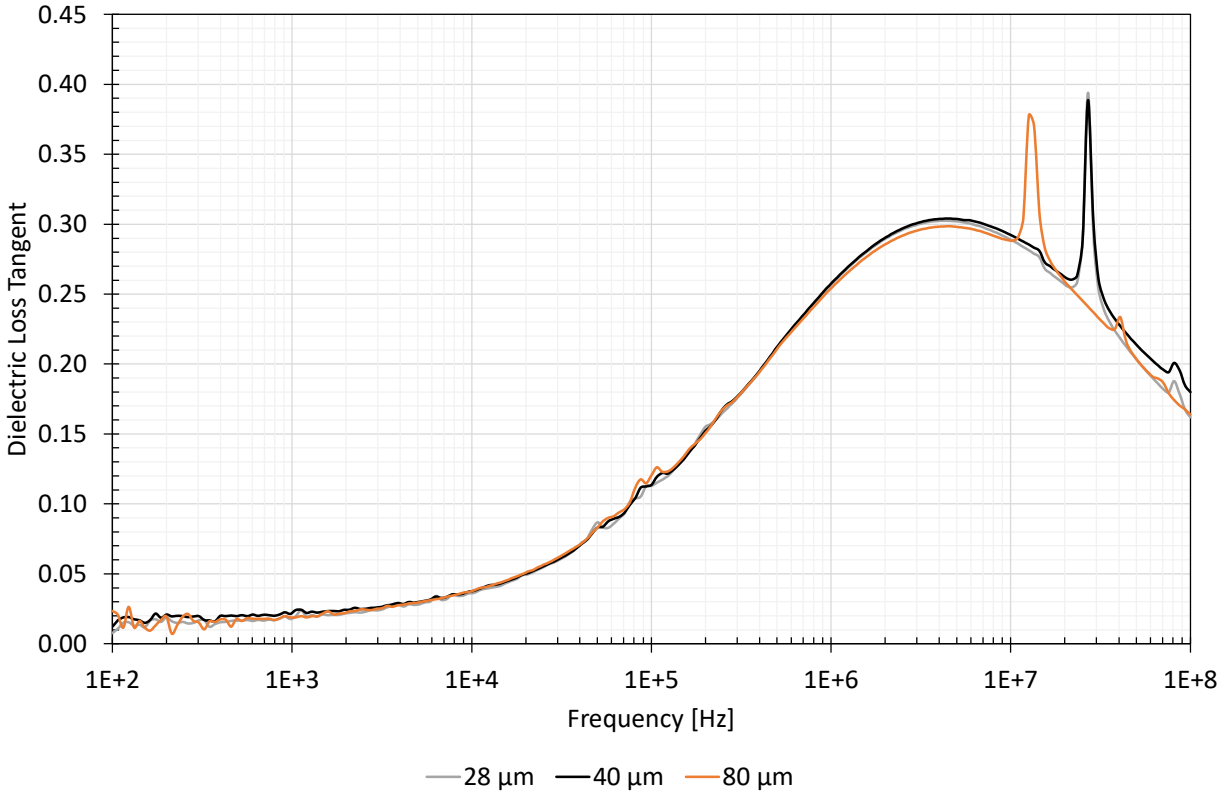

Figure 2 – Dielectric loss tangent of PVDF as a function of frequency

Single relaxation fit

Dielectric behaviour is often described by a single relaxation model. To account for asymmetry and broadness of the dielectric loss tangent the Havriliak-Negami relaxation is commonly used. This states that at a given frequency, f (in Hz), the complex relatively dielectric is given by

$$\varepsilon(f) = \varepsilon_\infty + \frac{\Delta\varepsilon}{(1 + \{if\tau\}^\alpha)^\beta}$$

where $\Delta\varepsilon = \varepsilon_0 - \varepsilon_\infty$ and where ε_0 and ε_∞ are the low and high frequency limits of dielectric constant respectively. This allows the broad trend of the dielectric spectrum to be described with only 5 constants. For our PVdF piezo-electric film, these constants are given below.

Constant	28 µm	40 µm	80 µm
$\boldsymbol{\varepsilon_0}$	14.5014	11.4256	12.0399
$\boldsymbol{\varepsilon_\infty}$	4.00927	266.138	2.02281
$\boldsymbol{\tau}$	42.791e-9	239.383e-9	226.942e-9
$\boldsymbol{\alpha}$	0.466657	0.600415	0.596793
$\boldsymbol{\beta}$	1.52906	0.69825	0.727596

PRODUCT SUPPORT

Disclaimer

All information is based on results gained from experience and tests and is believed to be accurate but is given without acceptance of liability for loss or damage attributable to reliance thereon as conditions of use lie outside the control of Precision Acoustics Ltd.

Warranty

The warranty will be for 12 months against defects of hardware component or manufacture only.

CONTACT DETAILS

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