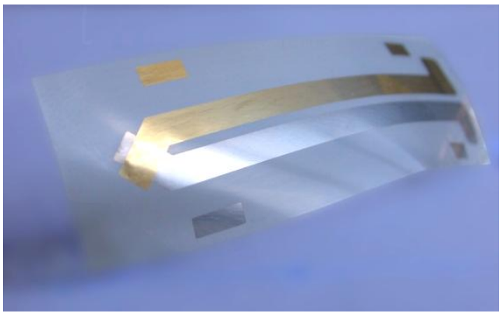
PVDF sensors

Technical information



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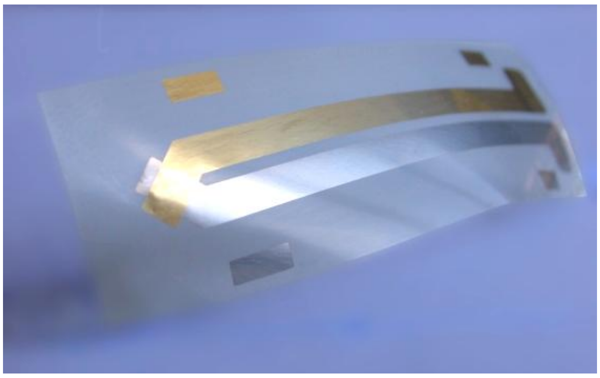
1 - PVDF shock sensors

Polyvinylidene fluoride sensors (PVDF) are the sensors of choice for a wide range of measurement applications because they have unique characteristics:

- Rapid response (Nanosecond)
- Large stress range (kPa to GPa)
- Large signal to noise ratio
- Sensitivity (4µC/cm2 for 10 GPa)
- Very thin (25µm)
- Simple circuitry



PIEZOTECH is the sole source for PVDF sensors suitable for shock physics research. The important features available only with PIEZOTECH ISL sensors include:

- **Reproducibility**: The sensors are all made from a high quality biaxially stretched polymer material, poled by the patented ISL-Bauer process to provide a stable and consistent polarization. Sputtered gold over chromium electrodes allow precise active area measurement.

- **Calibration**: These are the only PVDF sensors that are supported by extensive shock calibration data. These data range from a few kPa to over 25GPa.

- **Technical support**: The PIEZOTECH staff has significant experience in all aspects of PVDF fabrication and use. We stand ready to support your experimental efforts. We provide the guidance you need to apply the transducer to your experimentation or we can fabricate a complete transducer tailored to your needs.

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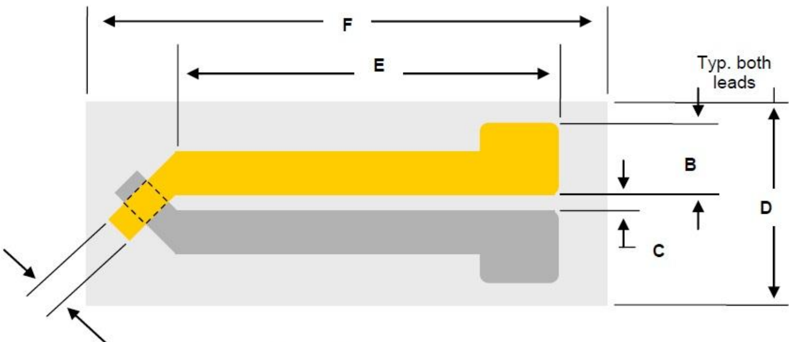
2. PVDF sensors specifications

Dimension (mm)	Sensors active area			
	1x1mm	2x2mm	3x3mm	5x5mm
A	1	2	3	5
B	2	2	3	5
C	1	1	1	1
D	19	19	19	19
E	50	50	50	50
F	65	65	65	65



Material	Bi-axially stretched **25µm** PVDF
Poling	Crossed lead strip sensing area **S_25 series: calibrated / remnant polarization= 9 ± 0.1 µC/cm²** **TOA series: not calibrated / standard piezoelectric film polarization**
Leads	Evaporation (1000 up to 1500 Ǻ gold over 40 Ǻ Cr)
Physical geometric	Quantitative definition of all parameters

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3. PVDF sensors models

Two series available:

- S_25 series: calibrated / remnant polarization= 9 ± 0.1 µC/cm²
- TOA series: not calibrated / standard piezoelectric film polarization

Series	**Model (*)**	**Description**	**Sensors active area available (mm)**
S25	S25_X	Basic PVDF sensor area with parallel lead	1x1 / 2x2 / 3x3 / 5x5
	S25C_X	S_25_X sensor with connector mounted	
	S25CP_X	S_25C PVDF sensor with Polyester protection on both sides(**)	
	S25CPB_X	S_25CP PVDF sensor electrically shielded	
TOA	TOA_X	Basic TOA sensor area with parallel lead	1x1 / 3x3
	TOAC_X	TOA_X sensor with connector mounted	
	TOACP_X	TOAC_X sensor with Polyester protection on both sides(**)	
	TOACPB_X	TOACP_X sensor electrically shielded	

(*) X correspond to the selected active area (expl: S25_9 for a 3*3mm active area).

(**) thickness of PE layer: 50µm.

9µm and 40µm thick are available for the S25 and TOA series upon request for a minimum delivery of ten sensors

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4. Piezoelectric Polyvinylidene Fluoride films

4.1 Piezoelectric and Pyroelectric effects

When certain materials are subjected to mechanical stress, electrical charges proportional to the stress appear on their surface. When an electric potential difference is applied to these materials, mechanical deformation occurs. This effect is known as piezoelectricity. When the temperature of the material is changed, an electric potential appears between the terminals: this is called the pyroelectric effect.

4.2 Piezoelectric Films

Piezoelectricity can be obtained by orienting the molecular dipoles of polar polymers such as PVDF in the same direction by subjecting films to an intense electric filed: this is the polarization. The polarized electrets are thermodynamically stable up to about 90°C.

PVDF is particularly suitable for the manufacture of such polarized films because of its molecular structure (polar material), its purity – which makes it possible to produce thin and regular films – and its ability to solidify in the crystalline form for polarization.

4.3 Properties of PVDF Piezoelectric films

- Flexibility (possibility of application on curved surfaces)
- High mechanical strength
- Dimensional stability
- High and stable piezoelectric coefficients over time up to approximately 90°C
- Characteristic chemical inertness of PVDF
- Continuous polarization for great lengths spooled onto drums
- Thickness between 9 microns and 1 mm

4.4 Examples of Applications

Pressure pick-ups

- Distribution of pressure on surface
- Localization of impacts
- Accelerometers
- Keyboards

Robotics

- Artificial sensitive skin
- Pressure sensors

Acoustic components

- Microphones
- Ultrasonic detectors
- Hydrophones
- Sonars

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Optical devices

- Laser diameter measurement
- Variable mirrors

Electrical components

- Switches
- Miniature electric fan

Security devices

- Intruder alarms
- IER alarms
- Vibration sensors

Medical instrumentation

- Catheter
- Pedobarography
- Osteogenesis
- Lithotrophy
- Medical echography
    - Blood pressure detector