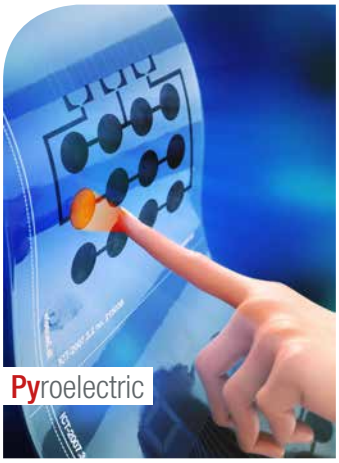
JOANNEUM RESEARCH MATERIALS

PyzoFlex®

An award winning, printed & flexible sensor technology for dynamic sensing of pressure/temperature changes as well as energy harvesting



THE INNOVATION COMPANY

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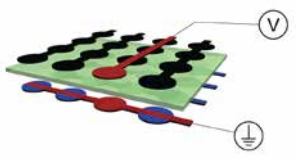
Advantages

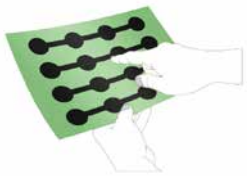
In various applications PyzoFlex® sensors show a range of unique advantages such as:

- Printability
- Scalability (large Area)
- Cost Efficiency
- Flexibility
- Freedom of Substrates & Design
- Robustness
- High dynamic detection
- Energy Self-Sustaining
- Spatial Resolution

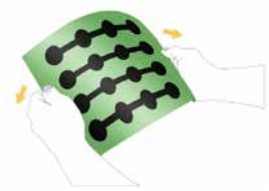
Applications



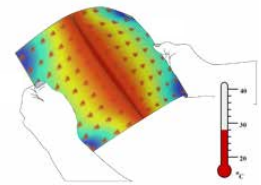
Energy harvesting
- Body movement
- Vibration
- Temperature changes
- Deformation
- Wind



Pressure sensing
- Membrane Keyboards
- Impact Detection
- Touch Interface
- Smart Surface/Floor
- Switch
- Security System
- Ambient Assisted Living



Flexible Sensors (bending)
- Flexible Displays
- Gaming
- Collaborative Robotics
- Wearable Consumer Electronics
- Smart Skin



Temperature sensing
- Laser Safety Systems
- IR-Detector
- Touchless Interaction
- Human Body Radiation

Key Facts: Sensor

Technology	Principle	Figure-of-Merit	Parameter
Piezoelectric-Pyroelectric sensing (active)	$\Delta Q \rightarrow \Delta I, \Delta V$ **Charge generation**	**Piezoelectric Coefficient** $d_{33,31} = \Delta Q/F$ **Pyroelectric Coefficient** $P = \Delta Q/\Delta T$ $(\Delta I, \Delta V = S * \sigma)$	**Dynamic** Pressure / Temperature, Strain, Vibration, Ultrasound Transducer, Accelerator, …

Key Facts Sensor		
Pyroelectric Coefficient p	20 – 30 µC/m²K	Depending on polymer composition & crystallinity
Piezoelectric Coefficient d_{33}	-25 – -38 pC/N	Depending on polymer composition & crystallinity
Remnant Polarization	60 – 75 µC/m²	Depending on fabrication process
Coercive Field	50 MV/m	
Curie Temperature	120°C – 140°C	Depending on polymer composition

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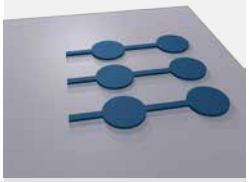
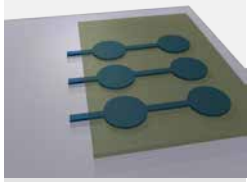
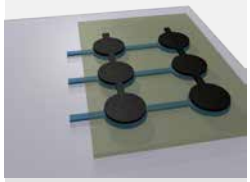
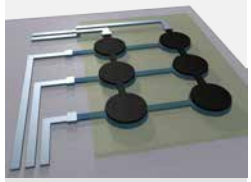
Standard fabrication process by screen-printing

Substrate	1st Electrode	Active Material	2nd Electrode	Connections
				
Plastic, paper, textile, glass, metal, transfer foils …	PEDOT: PSS (conductive, transparent polymer)	Copolymer: PVDF:TrFE-Ink (patented ink formulation)	PEDOT:PSS (for semi-transparent sensors) Carbon	Ag lines for connection to read-out electronics

Key Facts: Sensor-Fabrication

- Low temperature fabrication on flexible/rigid substrates (≤ 100°C)
- Substrate sizes up to 420 x 420mm with a thickness ≤ 20mm
- Semi-transparent sensors if solely PEDOT:PSS is used as electrode material
- Cost efficient sheet to sheet manufacturing by industrial screen printing process
- Application specific sensor shapes based on CAD designed screen masks (max. resolution = 12000dpi)
- Feature sizes down to 100µm (depending on material and screen)

Key Facts: Printing Equipment

- Thieme LAB 1000
- Alignment accuracy: (±) 10µm
- Full camera alignment
- High reproducibility due to software control
- Monitoring of printing parameters
- Process transfer to industrial lines

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