

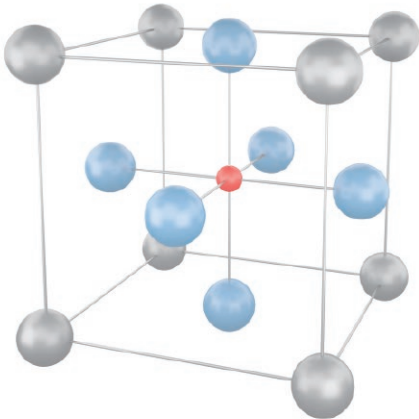


PI Ceramic

THE SPECIALISTS FOR PIEZO TECHNOLOGY

From the Material to the Piezo Transducer

Research, Development, and Production of Piezo Ceramic Components



The Piezoelectric Effect is the Basis for Sensors and Actuators

The mechanical force on a piezo element results in a measurable charge transfer. Conversely, the piezoceramic expands when an electrical field is applied.

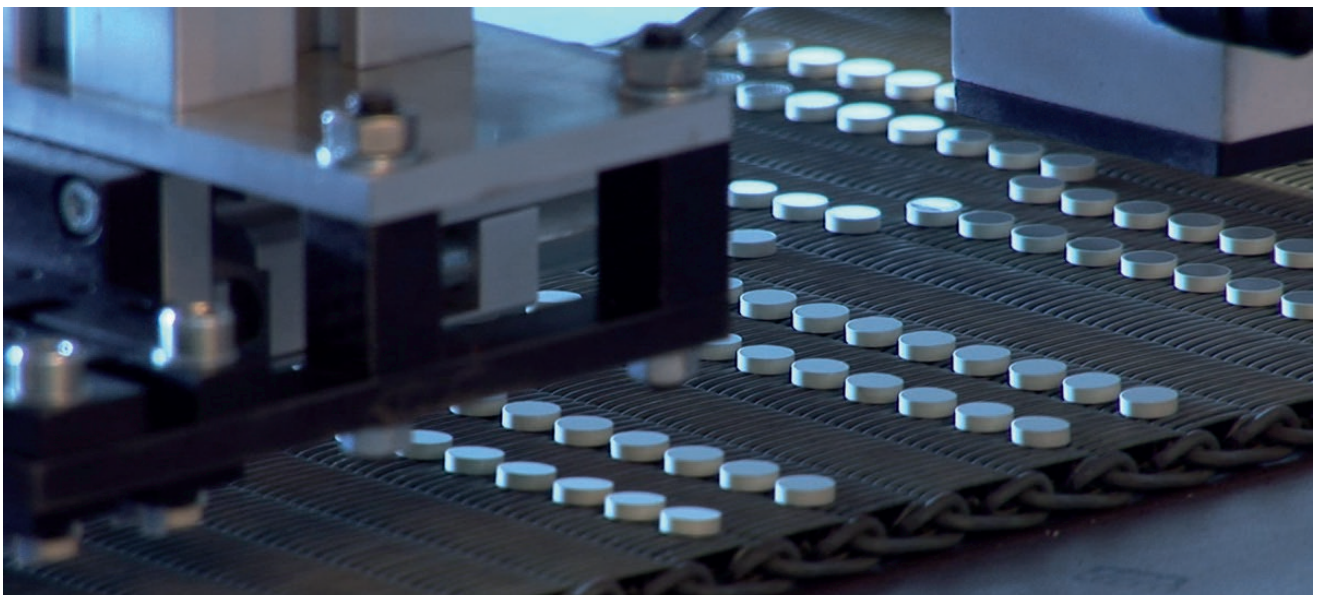
This makes it possible to manufacture sensors with a bandwidth of several kilohertz, which can be used in a variety of different ways. Vibrations, structure deformations, and also changes in force in the millinewton range can be detected. Ultrasonic transducers work at frequencies of up to a few megahertz.

In the case of actuator engineering, the short response time of a few microseconds is decisive. Piezo actuators achieve kilohertz frequencies and at the same time, generate high forces. Particularly for precision positioning, the piezoelectric principle is the basis for a positioning accuracy that is even lower than the nanometer range.

Production Know-How and Process Control

The design of a piezoelectric solution begins with the development and preparation of the piezoelectric materials. Piezo components are manufactured using pressing technology, are sintered, and equipped with electrical contacts. Polarization ensures the piezoelectric properties.

A core technology at PI Ceramic is the production of the PICMA[®] actuators. Tapes of a few 10 µm with screen-printed electrodes are sintered together. These „co-fired“ all-ceramic insulated multilayer actuators are particularly reliable.



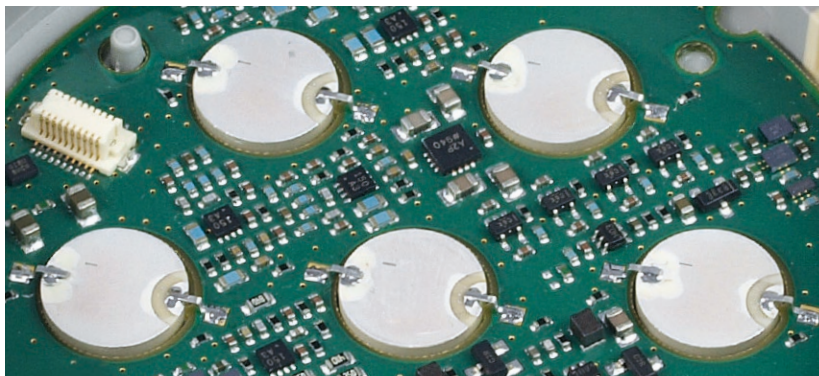
A Reliable Partner for Industry and Research

Leaders in Piezo Technology for Individual Solutions

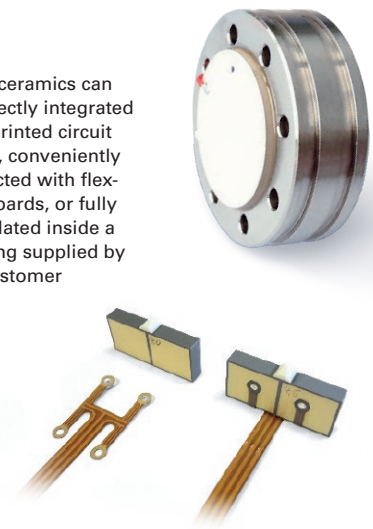
Flexible Adjustment of Actuators & Components

PI Ceramic is one of the world's leading manufacturers of piezo technology and an important development and production site of the PI Group. The fast and flexible adaptation of standard products to special areas of application is one of the core skills.

All process steps to the production and subsequent processing such as gluing and contacting the piezo elements take place in-house. This enables flexible adaptation of product, manufacturing, and test parameters for fast prototyping and, for later series in medium to large quantities up to some 1,000,000 pieces per year. Automated processes secure the constant high quality and keep costs low.



Piezo ceramics can be directly integrated on a printed circuit board, conveniently contacted with flexible boards, or fully encapsulated inside a housing supplied by the customer

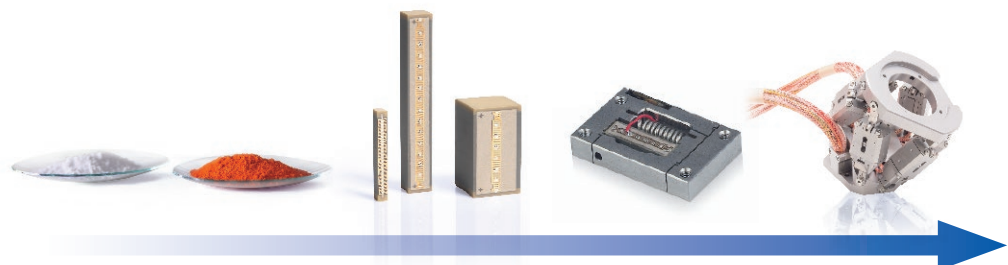


OEM Solutions and Application-Oriented Advice

The piezo specialists at PI Ceramic give extensive advice on system design to achieve optimum performance. Adaptation to the respective application includes selecting the optimum piezo material, shaping and contacting. PI Ceramic also supports during integration of the piezo elements with both advice and specific mechanical design. PI Ceramic takes care of all work steps reliably during the electrical and mechanical assembly.

PI Ceramic also offers specialized control electronics for piezo actuators ranging from laboratory devices to miniaturized OEM formats.

From piezo ceramic powder to sophisticated multi-axis nanopositioning devices: PI Ceramic plays an important role in PI's strategy of vertical integration



Product Overview

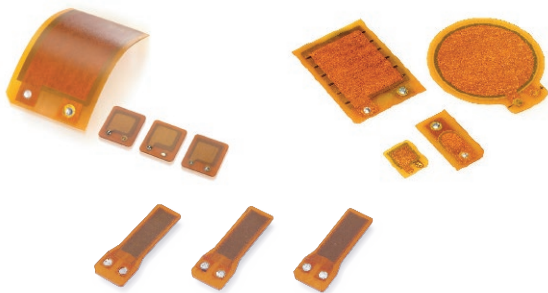
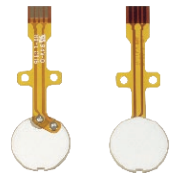
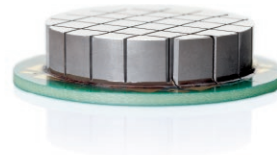


PIEZOELECTRIC COMPONENTS

- Various different versions in many different geometries such as disks, plates, tubes, customized shapes
- High resonant frequencies to 20 MHz

OEM ADAPTATIONS

- Piezo transducers for ultrasonic applications
- Assembly of complete transducer components
- 2D or line arrays



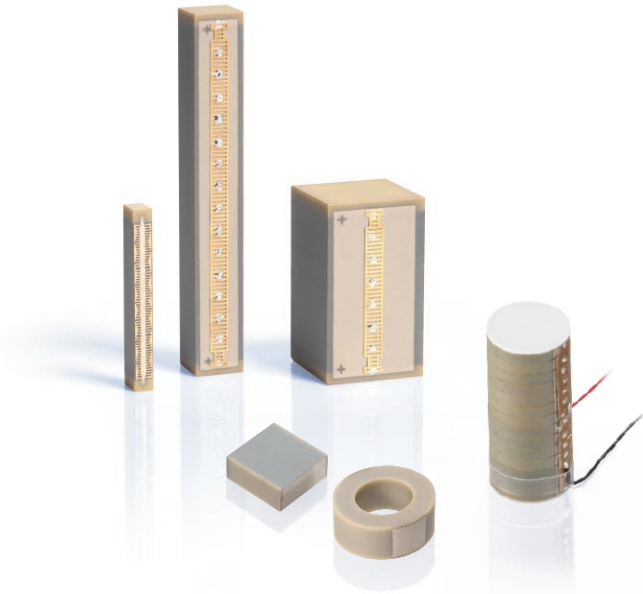
DURA ACT PIEZO PATCH TRANSDUCERS

- Actuator or sensor, structural health monitoring
- Bendable and robust, preloaded due to lamination



CONTROL ELECTRONICS

- Different performance classes
- OEM modules and benchtop devices

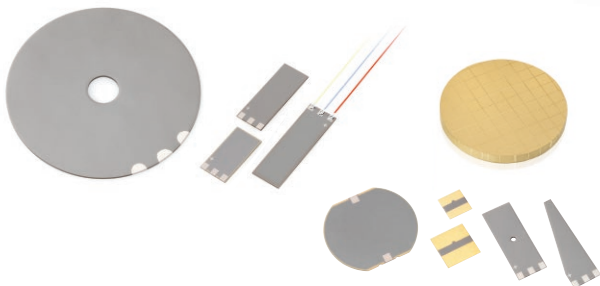


PICMA® MULTILAYER PIEZO ACTUATORS

- Low piezo voltage to 120 V
- High stiffness
- Travel ranges to 100 μm

PICA HIGH-LOAD ACTUATORS

- Travel ranges to 300 μm
- Forces to 100 kN

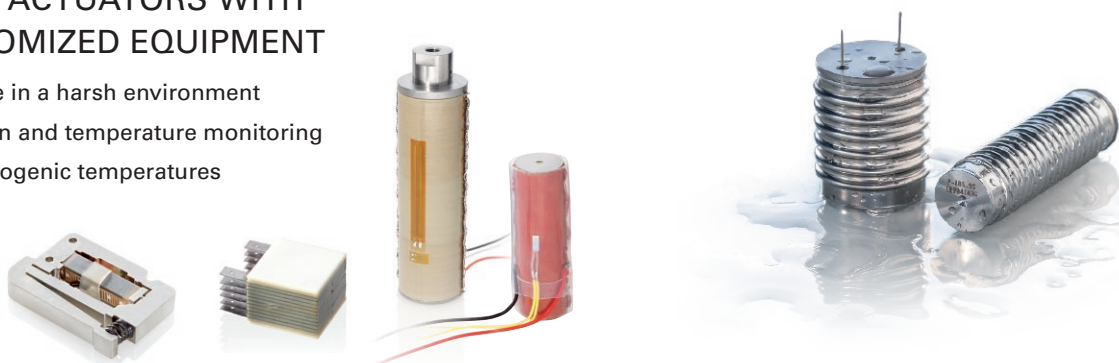


PICMA® MULTILAYER BENDING ACTUATORS

- Bidirectional displacement to 2 mm
- Low operating voltage to 60 V
- Contractors, variable contours

PIEZO ACTUATORS WITH CUSTOMIZED EQUIPMENT

- For use in a harsh environment
- Position and temperature monitoring
- For cryogenic temperatures



Applications and Solutions

From Noncontact Measuring Technology to Production in Mechanical Engineering



Air bubble detectors check for smooth flow during dialysis and transfusions (Image: Sonotec)

FLOW METERING, DETECTION OF FILL LEVEL OR FAULTS IN HOMOGENOUS MEDIA

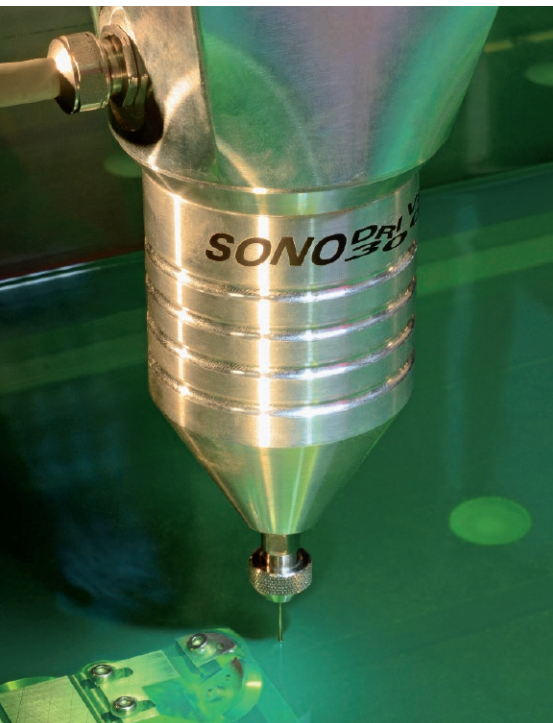
Measuring flow volumes is the basis for smooth control of processes such as those in modern building technology where the consumption of water, warm water, and heating energy is acquired. Even industrial automation, especially the chemical industry uses ultrasonic technology to acquire volume flow. Instead of weighing the quantity of the substance, continuous volume measurement takes place to control the overall process. The flow velocity and the concentration of certain substance can be acquired and it is even possible to measure gas quantities with ultrasonic techniques. Fill level and distance sensors work according to the same principle.

STRUCTURAL MONITORING

Piezo transducers are used for condition monitoring and adaptive systems. They generate and acquire surface waves that detect changes in structure before financial damage occurs.



Piezo sensors monitor structures at locations which are difficult to access such as offshore, pipelines or wind turbines (Image: istock)



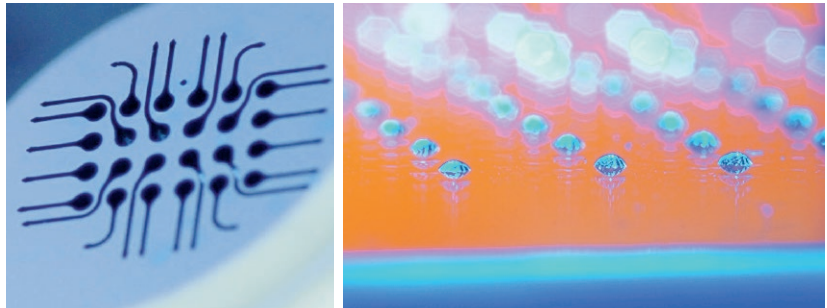
PRODUCTION PROCESSES IN INDUSTRY

The reliability of PI piezo actuators is required in many fields: In the semiconductor industry, precision mechanics and production as well as for switching applications and valve control, e.g., in automotive industry. It is used in processing thanks to its high forces during out-of-round turning. This also includes piezo actuators used in active vibration absorption, nanotechnology, metrology, optics, and interferometry.

Vibrating piezo actuators reduce processing times for high-precision micro-sized holes (Image: ICT-IMM)

PUMPING, DOSING, DISPENSING

Nanoliter dosing with jet technology in biotechnology to printing tiles or applying adhesive in microsystem technology: PICMA® piezo actuators are suitable for use in stationary and portable devices due to their reliability, flexible piezo voltage, and compact dimensions.



Precision dosing of droplets and printing microarrays thanks to highly dynamic piezo-based pipetting technology (Image: Biofluidix, Bernd Müller Fotografie)

GENERATING ULTRASONIC OSCILLATIONS

Very different applications make use of ultrasound. For example, high-power applications such as bonding techniques for wire bonding in the semiconductor industry and ultrasonic welding systems. Piezo elements are even at the heart of many devices in medical technology and generate ultrasound for surgical scalpels, instruments for removing plaque or for sonophoresis and ultrasonic therapy. Signal generators and sonars work with piezo ultrasound.



Piezoelectric sound transducers monitor the doors in the Airbus A380 (Image: Airbus, Holmco)

Wireless monitoring of the fetal heartbeat with combined ultrasonic sensor and receiver makes pregnancies safer and less stressful (Image: Philips)

The finest and particularly homogenous aerosols are created with the help of ultrasound (Image: Pari Pharma GmbH)



PROMISING TECHNOLOGIES

Research and development of new solutions for current and future applications is taking place in many fields of industry. For example, users expect haptic feedback not only from displays but also from new surfaces that are designed to be multifunctional. Adaptive systems such as focusing systems adapt their function to the changing ambient conditions. Piezo elements can ensure a decentralized energy supply to sensors or radio transmitters at locations that are difficult to access (Energy Harvesting).

Multifunctional surfaces supply perceptible signals as feedback for the user (Image: istock)



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