



- 1 Pressure die-cast bearing bolt with integrated piezo actuator for active oscillation damping.
- 2 X-ray of piezo actuator with metal housing manufactured with aluminum pressure die-casting.

## CAST<sup>TRONICS</sup><sup>®</sup>

# CASTING TECHNOLOGY- INTEGRATED PIEZO ACTUATORS

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The **CAST<sup>TRONICS</sup><sup>®</sup>** technology enables the in-process integration of electronic and adaptronic functional components during the casting process.

Thus, compared to conventional castings, extended electronic, sensor or actuator functionalities can be introduced.

### **Demonstrator: Cast actuator / Active bearing**

An embedded piezo-actuator in the cast actuator offers the possibility of actively coupling oscillations in the component structure. The oscillation behavior of cast components can then be actively influenced. The piezo-actuator is directly embedded in the aluminum die-cast housing. The actuator

is thus optimally integrated in the material structure of the housing and is provided with the necessary pre-stressing required for actuator applications through the die casting process. The integrated electronics are protected against dirt, dust and liquids during manufacturing and installation, as well as in operational use.

Additional machining and joining processes can be omitted through this in-process integration of the functional elements, offering cost reduction potential in the manufacturing of metal components with integrated piezoelectric ceramics.



### Function principle of piezo actuators

The technical function principle of piezo actuators is based on the piezoelectric effect. The application of an electric voltage shifts the electric charges in the crystal structure of the piezoelectric ceramic, inducing an active deformation of the piezoelectric material. Extremely small response times of several microseconds are realizable. In the reversal of this effect, mechanical deformation (for example due to compressive or tensile forces or vibrations) allows piezoelectric materials to generate electrical charges in their crystal structure and these can be used to derive the sensor signal for the corresponding load.

### Application potential

#### Metal housings for piezoelectric ceramics

The **CAST<sup>TRONICS</sup>**® technology offers an innovative possibility for integrated piezo actuators and sensors directly in a metal housing made, for instance, of aluminum or zinc. The piezo can be directly contacted via the »plug-in« housing which can be prepared for installation with a threaded or flange connection.

#### Active oscillation damping

Oscillations in machines or components can have a negative effect on their function and increase wear. These oscillating masses can be damped through the use of piezo actuators (example: active bearing).

### Component acoustics

Oscillations in components, particularly in combination with hollow spaces, frequently have a negative effect on the acoustic behavior of the component. The oscillations can be mutually superimposed through targeted phase shifting by means of a combination of oscillation measurements and the possibility of active oscillation damping. This allows active intervention in component acoustics.

### Our Offer

The Casting Technology and Component Development department at Fraunhofer IFAM can support you through the entire process chain of the **CAST<sup>TRONICS</sup>**® technology:

- Brainstorming and project consultancy
- Selection of piezoelectric ceramics
- Design of insulation materials and geometry
- Concept development for positioning in the mold
- Simulation of the casting process
- Test casting series
- X-ray scanning and computer tomography

You can find further information on our website

[www.castronics.de](http://www.castronics.de)

**3** Active bearing system with active oscillation damping die-cast actuators.