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# Setting up a pressure sensor with flush membrane and without oil filling

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**Summary:**
For high -pressure applications over 70 MPa, thin layer technology is mainly used on steel. With this technology, sensors with a front -bundle connection can only be realized with great effort. This paper contains a technology for a sensor with a front -bundle media connection and strict separation to the electrical side. Use are used for cross-no-sensitive SI-DMS. These are added to the media facing the media using a glass frit.

Various technologies and measurement principles are used to manufacture pressure sensors. The piezoresistive measurement principle is most widespread. To implement the measuring resistors, thick layer or thin-layer but also implanted measurement resistors are used in silicon. The deformation body for the thick layer or thin layer technology is made of ceramic or steel. The structure is largely standardized. In the case of silicon -based pressure sensors, there is a wide range of constructions.

A requirement is similar in all principles, the separation from the electrical side and the media.

The electrical side includes both the measuring resistances and the electrical connections with signal processing.

In silicon -based sensors, this is done with an oil filling and a separating membrane. In many cases, a flush front surface is advantageous, since there is no dead volume in the tube.

The steel and ceramic sensors are operated from the back. The measurement resistances are mandatory on the planar front. Different pressure sensors and a flush front surface cannot be realized.

The goal of arranging the measurement resistances is a full bridge. For this purpose, similar measurement resistors are placed on the deformation body in areas of negative and positive mechanical tension.

For high pressures from 700 bar, steel is primarily used as a deformation body. Due to the prevailing technology, the geometric size is limited downwards. Even a flush front area can only be implemented with great effort.

There is essentially a demand for the following properties:

- Small, flush front surface <Ø 5 mm
- Temperature range up to 200 ° C, injection molding tool
- Pressure range> 700 bar.

These requirements can be easily met if the measuring resistances can be positioned in the middle of the bending plate on the back. This is how the flush front area represents the media side. For a technological solution, the challenges at different positions lie:

- Severe accessibility of the back, lithography and screen printing are not possible
- The edge area is not accessible to position the measuring resistances, only a half -bridge is possible
- Isotropic stress field in the middle of the plate, measurement resistances with very low cross -quality sensitivity are required.

Fig. 1 shows the simulation of a deformation body with a load of 100 MPa from above. The line graph of the mechanical voltage on the underside and the top of the plate is shown in Fig. 3 and Fig. 4. The use of measuring resistors would be on the edge of the plate and in the middle for the well -accessible top. A position in the middle, since there is an isotropic stress field, requires measurement resistances with low sensitivity to cross. If this is not the case, the effect is greatly reduced. For assembly on the back, only the heavily accessible center is eligible, since the edge is practically not accessible. The solution is based on a Si-Strain Gauge, which is placed on the back by a glass frit connection and in the middle of the plate. The measurement resistances have a minimal a cross-stretch sensitivity. A split deformation body is used. After electrical contact, this is added by a welding process.

Fig. 2 and Fig. 5 show the plate from the back with a added Si Strain Gauge, as a half bridge.

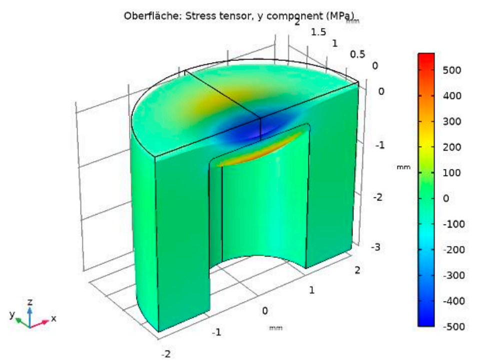


*Fig. 1. Simulation deformation body, 100 MPa load from above*

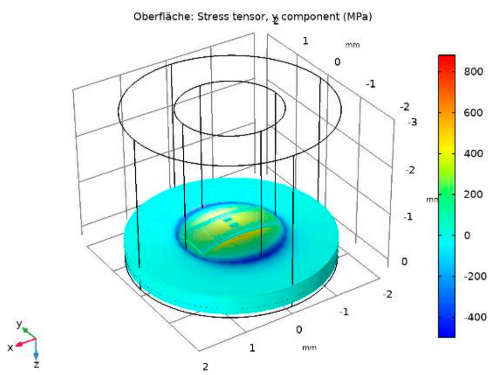


*Fig. 2. Pressure sensor with a cross-stretch insensitive Si-Strain Gauge*

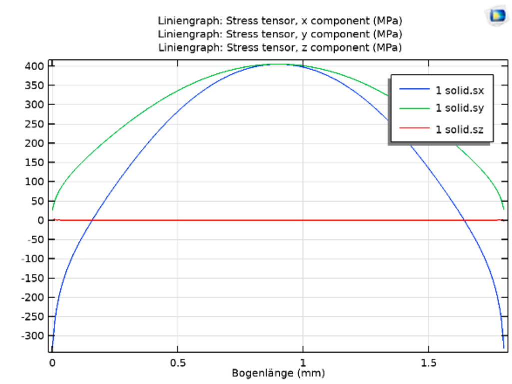


*Fig. 3. Line graph of the mechanical stress on the underside of the plate.*

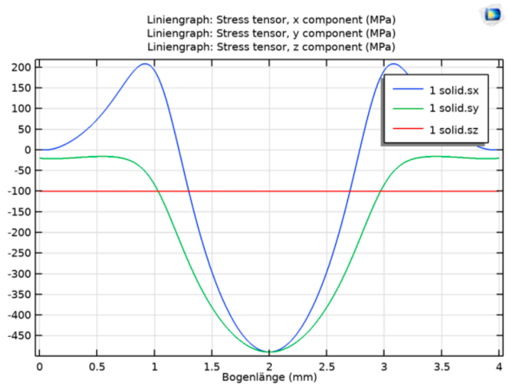


*Fig. 4. Line graph of the mechanical stress on the top of the plate.*

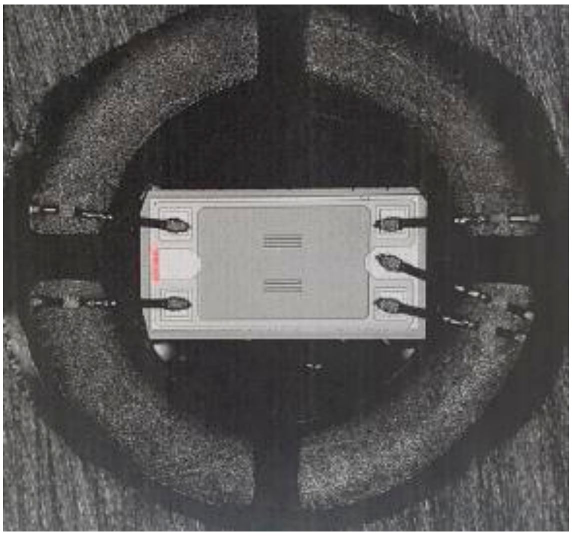

*Fig. 5. Pressure sensor with a cross-stretch insensitive Si-Strain Gauge*