Support Information

Simulate the sensor model under pressure (load 50Mpa). The X axis is the straight line where the two fixed columns are located, and the Y axis is the straight line perpendicular to the X axis in the plane of the pressure diaphragm. The vertical direction of the pressure diaphragm is the Z axis. The deformation distribution inside the sensor is shown in the figure1a-3a.

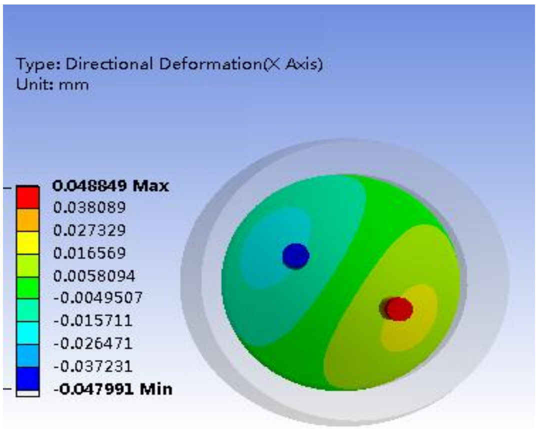

Fig1a X Axis Deformation of inside sensor casing

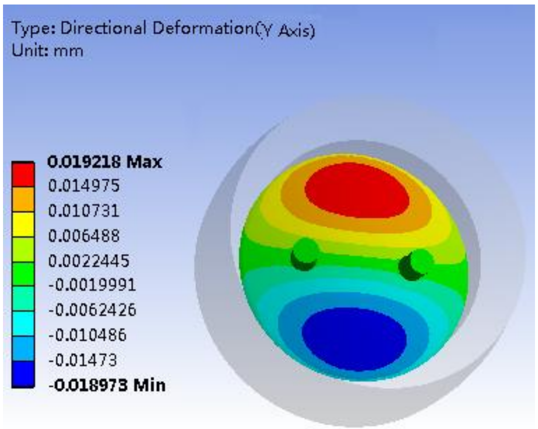

Fig2a Y Axis Deformation of inside sensor casing

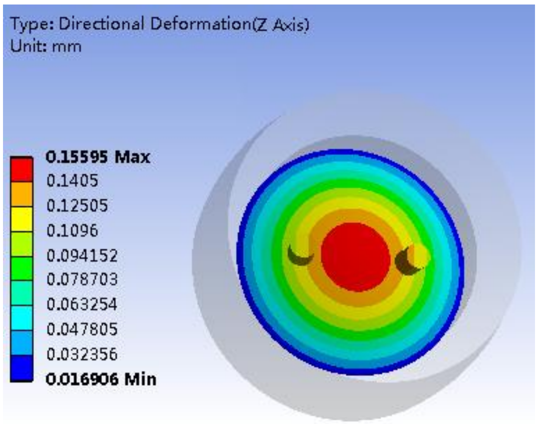

Fig3a Z Axis Deformation of inside sensor casing

As can be seen from figure1a-3a, when the pressure perpendicular to the plane of the sensor model is loaded, the structure can convert the pressure into two X-direction deformations of the two fixed column. In the Y and Z directions, the two fixed columns have the same deformation and no relative change. When the grating is pasted between two fixed columns, the change in pressure produces only axial strain without radial strain. At the same time, it can be seen from figure 1a that the two fixed columns are the most deformed places in the whole model, and the maximum sensitivity is obtained by pasting the grating between two fixed columns. And the sensitivity can be adjusted by changing the height of the column.

Compared with related grating pressure sensors, the results are shown in Table 1a:

references	Pressure measuring range（Mpa）	Operating temperature（℃）	Suitable medium	Structural features
[17]	0.1	Not involved	Liquid、gas	The grating is placed in the center of the flat diaphragm.
[16]	0.2	120	Liquid、gas	In this sensor, the grating is exposed to the outside and is easily damaged in practical applications.
[15]	1	100	Liquid、gas	The grating is placed in the center of the flat diaphragm.
[23]	100	200	Liquid、gas	In this sensor, the grating is placed on the cantilever beam. The pressure change will cause the grating to deform axially and radially at the same time and affect the accuracy.
[4]	25	200	Liquid, gas, solid	In this sensor, the grating is directly connected with the shell, and the pressure change will cause the axial and radial deformation of the grating to affect the accuracy.
[9]	10	80	Liquid, gas, solid	In this sensor, the grating is directly connected with the shell, and the pressure change will cause the axial and radial deformation of the grating to affect the accuracy.
[3]	3.5	80	Liquid、gas	Not involved
[10]	0.5	Not involved	Liquid, gas, solid	In this sensor, the grating is directly connected with the shell, and the pressure change will cause the axial and radial deformation of the grating to affect the accuracy.
[11]	0.45	Not	Liquid, gas, solid	In this sensor, the grating is directly connected

		involved		with the shell, and the pressure change will cause the axial and radial deformation of the grating to affect the accuracy.
This work	50	300	Liquid, gas, solid	In this sensor, the external pressure is converted to the axial strain of the grating by adding a fixed column and the sensitivity of the sensor is increased. At the same time, the sensitivity can be adjusted by changing the height of the fixed column.

In this design, the sensitivity of the sensor is improved completely through the design of the structure， although the sensor designed in this paper has no obvious advantage in sensitivity,which is due to a large scale.Excessive sensitivity at high range and high temperature will cause excessive deformation of the grating and cause grating damage.To sum up, the sensor designed in this paper has unique advantages in design and performance, especially for the safety and applicability of the weapon system.

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