CHEMICAL SENSOR PACKAGE FOR HIGHLY PRESSURED ENVIRONMENT

FIELD OF THE INVENTION

[0001] The invention relates to chemical sensor package. More specifically, the invention relates to chemical sensor package for high pressure environment.

BACKGROUND

[0002] Chemical sensors have been used for several areas such as laboratorial or industrial testing and oceanic scientific expedition or oil prospecting. Also, additional encapsulation and packaging is typically required depending on the intended use and application environments.

[0003] In some environment such as oceanic applications, high pressure is applied to the chemical sensors and packaging for protecting the chemical sensors from high pressure environment is necessary. For instance, at 3 km below deep sea application, pressure could be increased to 20kpsi (138 MPa). For the sensor application under such a highly pressurized condition, the pressure differential between the external environment and internal structure of the sensor can be substantial. Existing packaging solutions are unable to withstand such a high pressure difference, limiting their usage for such a high pressure environment.

[0004] Thus, what is needed is an improved chemical sensor package that withstands a highly pressurized condition. Furthermore, other desirable features and characteristics will become apparent from the subsequent detailed description and the appended claims, taken in conjunction with the accompanying drawings and this background of the disclosure.

SUMMARY

[0005] In a first aspect of the present invention, a chemical sensor package for highly pressured environment is disclosed. The chemical sensor package includes an encapsulation for encapsulating a chemical sensor, having a hole for exposing a chemical sensitive part of the chemical sensor for sensing purpose; a pressure balancing structure for balancing pressure applied to the chemical sensor at the chemical sensitive part, wherein the pressure balancing structure is a pressure balancing hole for

applying counter pressure to the chemical sensor at the opposite side of the chemical sensitive part; and a Redistribution Layer (RDL) on the chemical sensor for moving a wiring outside of the encapsulation away from the opposite side of the chemical sensitive part.

[0006] In a second aspect of the present invention, a method for packaging a chemical sensor is disclosed. The method includes encapsulating a chemical sensor; providing a hole for exposing a chemical sensitive part of the chemical sensor; and providing a pressure balancing structure for balancing pressure applied to the chemical sensor at the chemical sensitive part.

[0007] In a third aspect of the present invention, a pressure resistant chemical sensor is disclosed. The pressure resistant chemical sensor includes a chemical sensor; an encapsulation for encapsulating the chemical sensor, having a hole for exposing a chemical sensitive part of the chemical sensor for sensing purpose; a pressure balancing structure for balancing pressure applied to the chemical sensor at the chemical sensitive part, wherein the pressure balancing structure is a pressure balancing hole for applying counter pressure to the chemical sensor at the opposite side of the chemical sensitive part; and a Redistribution Layer (RDL) on the chemical sensor for moving a wiring outside of the encapsulation away from the opposite side of the chemical sensitive part.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] The accompanying figures, where like reference numerals refer to identical or functionally similar elements throughout the separate views and which together with the detailed description below are incorporated in and form part of the specification, serve to illustrate various embodiments and to explain various principles and advantages in accordance with the present embodiment.

[0009] FIG. 1 depicts a chemical sensor package with pressure balancing hole in accordance with a present embodiment.

[0010] FIG. 2 depicts a chemical sensor package with pressure balancing supporting structure in accordance with a present embodiment.

[0011] FIG. 3, comprising FIG. 3a to FIG. 3c, illustrates simulation models of a bending stress under high pressure loading condition, wherein FIG. 3a illustrate conventional chemical sensor package, FIG. 3b illustrates a chemical sensor package with pressure balancing hole in accordance with a

present embodiment and FIG. 3c illustrates a chemical sensor package with pressure balancing supporting structure in accordance with a present embodiment.

[0012] FIG. 4 depicts a flowchart of a method for packaging a chemical sensor in accordance with a present embodiment.

[0013] FIG. 5 depicts a detailed packaging flow in accordance with a present embodiment.

CLAIMS

1. A chemical sensor package for highly pressured environment comprising:

an encapsulation for encapsulating a chemical sensor, having a hole for exposing a chemical sensitive part of the chemical sensor for sensing purpose;

a pressure balancing structure for balancing pressure applied to the chemical sensor at the chemical sensitive part, wherein the pressure balancing structure is a pressure balancing hole for applying counter pressure to the chemical sensor at the opposite side of the chemical sensitive part; and

a Redistribution Layer (RDL) on the chemical sensor for moving a wiring outside of the encapsulation away from the opposite side of the chemical sensitive part.

2. The package in accordance with claim 1, wherein the pressure balancing structure is a pressure balancing supporting structure for applying counter pressure to the chemical sensor at the opposite side of the chemical sensitive part.

3. The package in accordance with claim 1, further comprising Redistribution Layer (RDL) on the chemical sensor for moving a wiring outside of the encapsulation away from the opposite side of the chemical sensitive part.

4. The package in accordance with claim 1, further comprising Through Mold Via (TMV) interconnection for connecting the chemical sensor to the wiring outside of the encapsulation.

5. The package in accordance with claim 1, wherein the package is fabricated through fan-out wafer level packaging (FO-WLP) processes.

6. The package in accordance with claim 1, further comprising a hydrophobic conformal coating on the encapsulation.

7. The package in accordance with claim 1, wherein the chemical sensor is an ion sensitive field effect transistor (ISFET) sensor and the chemical sensitive part is an Ion sensitive layer.

8. A pressure resistant chemical sensor comprising:

a chemical sensor;

an encapsulation for encapsulating the chemical sensor, having a hole for exposing a chemical sensitive part of the chemical sensor for sensing purpose;

a pressure balancing structure for balancing pressure applied to the chemical sensor at the chemical sensitive part, wherein the pressure balancing structure is a pressure balancing hole for applying counter pressure to the chemical sensor at the opposite side of the chemical sensitive part; and

a Redistribution Layer (RDL) on the chemical sensor for moving a wiring outside of the encapsulation away from the opposite side of the chemical sensitive part.