

Sensor Head for Hydrogen Detection

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INTRODUCTION

The goal of the "deteH" project is to develop a new generation of hydrogen and hydrogen compounds sensor, indented for applications in above normative conditions. This new generation of resistance hydrogen sensors will utilize nanostructural material composed of different allotropic forms of carbon and palladium nanograins as the active layer. A new head for the sensor has been developed. The active layer is deposited on an alumina substrate. The substrate is placed in a holder containing a thick film heater, a temperature sensor and electrical contacts to the active layer. This article presents details of the sensor head construction and results of the initial tests.

SENSOR HEAD – ACTIVE ELEMENT

The major element of the sensor head is a 11 mm × 11 mm alumina ceramic plate that acts as a substrate for sensing film deposition. On one side of the substrate, titanium contacts were deposited, followed by the deposition of the active film. On the other side, a thick-film heater was manufactured [Fig. 1].



Fig. 1 Cross-section of the ceramic plate with the active film.

The heater was manufactured by screen printing and consists of two silver electrodes and a $\text{Bi}_2\text{Ru}_2\text{O}_7$ resistor [Fig. 2]. The heater's resistance is about 1,2 k Ω . Placement of the heater on the same substrate allows to stabilize the sensor's temperature by increasing it to about 20 K above ambient temperature. It can also be used for rapid sensor regeneration, as the hydrogen solubility in palladium decreases with temperature.

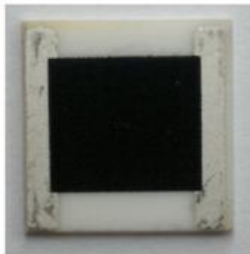


Fig. 2 Picture of the thick-film heater on a 11 mm × 11 mm alumina substrate.

SENSOR HEAD – PACKAGE

In order to connect the active film and the heater to an electronic measurement device, a special package for the sensor plate had to be developed [Fig. 3]. The package also provides a connection to the heater. In order to provide a feedback for temperature stabilization, a thermistor was incorporated in to the design.

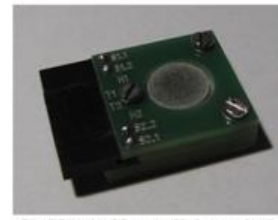


Fig. 3 Picture of the assembled sensor head.

The package consists of four FR-4 laminate boards with copper contacts and tracks [Fig. 4]. The top most board provides electrodes for a four-point measurement of resistance of the active layer. The second board is a holder for the ceramic plate with the active film and the heater. The third layer provides an electrical connection to the thick-film heater. It also contains a 0805 size SMD thermistor. The bottom board facilitates only a mechanical function, being a housing for three M2 nuts. A 8-pin "gold-pin" socket is used the sensor head connector.

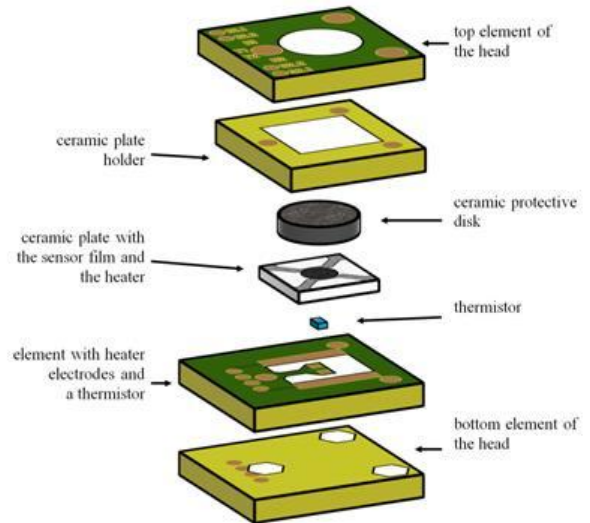


Fig. 4 Exploded view of the sensor head (connector and screws not shown).

ACKNOWLEDGEMENTS

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