A NOVEL COST EFFECTIVE MANUFACTURING PROCESS FOR ENVIRONMENT SENSORS

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BACKGROUND

A sensor is a converter that measures a physical quantity and converts it into a signal which can be read. Environment sensors measure humidity, temperature, and gases. They have many uses in the industry including
air quality monitoring, gas sensing, and potential emerging applications such as hydrogen fuel cells and combustion batteries. According to BCC, the global markets for environmental sensors and the related subsegments (e.g., monitoring, networks, remote sensing) account for approximately $13 billion of economic activity at present, with a projected average annual growth of 5.4% through 2016. The majority of commercial sensor technologies (catalytic, thermal, MOx, MOS, optical) are based on complex fabrication processes.

TECHNOLOGY

Dielectric resonators are a good choice for gas sensing because of their large surface area and sensitivity to the external environment. The relative permittivity of the dielectric resonator changes according to the concentration of the target gas, based on which dielectric resonators function as gas sensor. However, it should be of concern that common cylindrical dielectric resonators in millimeter-wave frequency band become difficult to machine because their dimensions are impractically small when used in the conventional TE or TM modes.

Our technology is a new fabrication process for environment sensors that drastically reduces the cost by simplifying the production process, while preserving the sensor's sensitivity. It is based on a new generation of electromagnetic devices integrated to the substrate.

The sensor contains a resonating cavity integrated in its substrate. This cavity is filled with a dielectric which is selective to the substance to detect. The detection principle is thus based on the change in permittivity of the detecting material in the presence of the substance to detect. This variation induces a frequency shift that is easy to detect.

Various detecting materials can easily be integrated on a single fabrication unit thus reducing costs. The proposed technology can also be used with wired or wireless sensors.

We estimate the following parameters:
-Estimated threshold for hydrogen detection around 100ppm
-Fabrication cost of less than 10$
-Energy consumption of around 1mW for the sensor component
-Size of current prototype is 3cm X 3cm but could be decreased to 1cm x 1cm

Only the functional material used affect the sensor's longevity, which is estimated at 40,000 hours for hydrogen detection.

COMPETITIVE ADVANTAGES

-The main strengths of the technology are:
-Novel production method for the proposed sensors.
-Possibility to manufacture with most actual technologies (PCB, LTCC, printable electronics, etc.).
-Many applications due to the generic and flexible technology used.

Our analysis of the manufacturing cost of sensors based on this new technology indicates a significant cost reduction.

APPLICATIONS

Several potential industrial, commercial, residential, and emerging applications exist, such as air quality monitoring, gas sensing, hydrogen applications, and combustion batteries.

TECHNOLOGY DEVELOPMENTAL STAGE

Proof of concept and first prototypes developed and tested.

PATENT STATUS

Granted US 9,625,366

BUSINESS OPPORTUNITY

For licensing and co-development of the technology.

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