Technology Offer

Touchless Positioning Interface: The Precise Nanosheet Moisture Sensor

Ref.-No.: 1201-4882-BC

The invention relates to a new precise sensing device for gas and vapor that is based on a 2D nanosheet material. A remarkably high sensitivity allows for the application in smart touchless interfaces to operate future digital devices.

Sensors for environmental changes are one of the most promising approaches for touchless interface devices but state-of-the-art technologies are not satisfactory. They typically exhibit too long response times.

With its capability to resolve sub-centimeter humidity gradients with a high sensitivity and quick response, the new sensor is particularly suited for this application. It is based on a nanosheet of active material that changes its electrical or optical properties upon exposure.

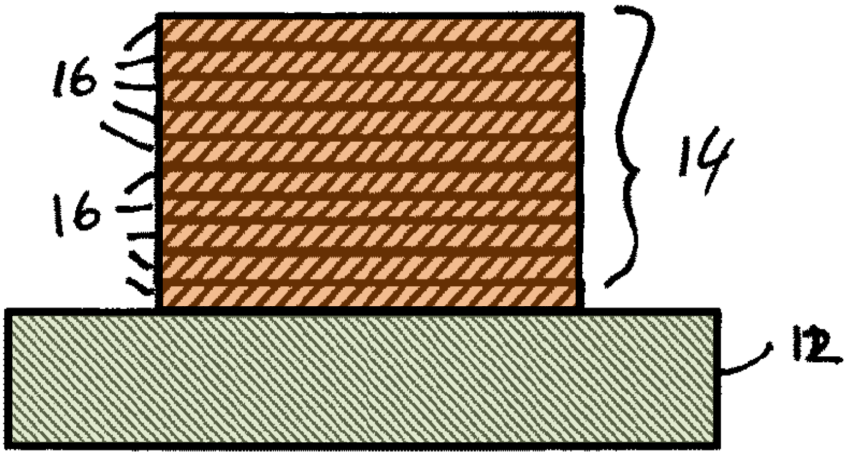

Fig. 1: Schematic of a device according to the invention. A substrate of glass (12) is covered by a layer of active material (14). This layer is composed of a plurality of nanosheets (16).

Advantages

- High response range over 5 orders of magnitude
- Quick response time
- Sub-cm spatial resolution
- Detection of specific compounds in gas like CO_2
- Devices as thin sheets

Applications

- Touchless Positioning Interface (TPI)
- Gas detection
- Resistive relative humidity sensors
- Smart and privacy windows

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Background

The exponential growth in digital technology development for a wide variety of electronic devices, such as laptops, smartphones or tablets necessitates the rapid development of novel hardware control systems. In this context, humidity sensors are promising candidates for use in smart touchless positioning interfaces (TPI) which operate based on local variations in the humid environment around the human finger. However, the existing devices are not satisfactory because they typically exhibit too long response times. Moreover, the spatial sensitivity of these devices is so far not suitable for the implementation in smart touchless positioning interfaces.

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To overcome the aforementioned shortcomings, an advanced moisture sensing device was developed. In accordance with the present invention, such a device comprises at least one nanosheet of an active material having a first optical thickness. The active material experiences a change (i) in size, (ii) of the resistance, (iii) of the resistivity, (iv) of the refractive index or (v) combinations of two or more of the foregoing, when the active material is subjected to a change in environment.
Such a device having a planar 2D structure can be used in various sensing applications, as they respond with a high sensitivity and within a very short time to changes in the environment, such as in the level of humidity. More specifically, a response range of over 5 orders of magnitude in resistance, a good cyclability and fast response and recovery times in the range of a few seconds allow the new sensor to be used in touchless interfaces. A response in the form of optical property changes of the active material can in turn be used for direct visual feedback at the interface or even for different applications like smart windows.
Additionally, a sensor according to the present invention can also be used for the detection of specific compounds like solvent vapors or gases such as CO_2. This further increases the range of applications.

Patent Information

PCT *(WO2016102139A1)*, EP, US, JP, CN, KR

Publications

M. Däntl et al. *“Customizing H3Sb3P2O14 nanosheet sensors by reversible vapor-phase amine intercalation”*, Nanoscale Horiz. 5 (2020)

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