Visible light-activated chemoresistive gas sensor array

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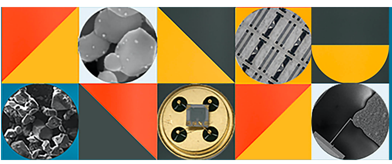
Abstract

Internet of Things (IOT) technology is one of the most influential technology in the Fourth Industrial Revolution. Various electronic devices were developed such as sensors and actuators. Chemical sensor such as gas sensor and physical sensor such as temperature sensor, humidity sensor were researched briskly. Among them, gas sensor has gained numerous attention due to its wide range of application and advantages. Detecting harmful gases inside the buildings and cars and improving the indoor air quality became extremely important. Thus, chemoresistive sensors have gained tremendous attention due to easy fabrication process, high response to gas and low electric power consumption. Various metal oxides were applied in chemoresistive sensing materials for decades exhibiting high response, a wide range of detection and fast recovery. However, a high operating temperature was required to activate the gas sensing behaviour in metal oxides. An external heater must be applied to elevate the temperature over 200 ºC, which increases the production cost and electrical power consumption. This neutralizes the advantages of the chemoresistive gas sensor and may further degrade the potential of the chemoresistive gas sensor for smart sensors. Thus, to resolve the heater problem, visible light illumination is adopted in this work to activate the chemoresistive gas sensing at room temperature. In this work, SnS_2 nanoflowers and SnO_2 nanoparticles along with various metal doping, metal decoration were selected as sensing materials enabled by visible light activation. The whole process was based on solution process without any vacuum equipments. SnS_2 nanoflowers and S-doped SnO_2 nanoparticles were synthesized by hydrothermal method. Various metal components were doped and decorated on SnO_2 nanoparticles to effectively control the gas selectivity. Based on material screening for visible light-activated gas sensing, sensor arrays were fabricated on micro-LEDs. The sensor array exhibited excellent gas sensing performance which was activated by visible light with extremely small exposure area. Further gas sensing measurements were conducted and analyzed.



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