In_2O_3-based gas sensors for ppb-level O_3 detection

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Ozone (O_3) is a typical pollution in air produced by photo-chemical reactions between nitrogen oxide (NOx) and volatile organic compounds (VOSs) under ultraviolet radiation [1]. Human's immune and respiratory system will be hurt under long-term O_3 exposure [2]. 50 ppb has been set as 8-h O_3 exposure threshold to human beings, specified by the World Health Organization (WHO) [1]. Thus, for realizing high response and low detection limit of O_3 gas sensors, the regulation to sensing materials is an effective means. Herein, the systematical study on In_2O_3 nanomaterials was carried out to investigate the interplay between O_3 sensing behaviors and material properties. Morphorlogy ajustment, surface active site modulation, crystalline phase regulation and bimetallic nanocatalyst decoration were employed to optimize sensing layers. For gas-sensing measurements, a dynamic distribution system was setup to generate O_3 gas and calibrate its concentration (**Fig. 1**a). Until now, the lowest detection limit of our optimized O_3 sensor was 30 ppb (R_a/R_g=5.0), indicating remarkable sensing performances and promising applications. The great sensing behavior is proved to be closely related to the oxygen-chemisorbed ability and band gap optimization of sensing layers. Taken together, our work inspires a new perspective to design sensitive and reliable O_3 sensors.

[1] Y. J. Onofre, Appl. Surf. Sci. **478**, 2019 (347).

[2] I. Manisalidis, Front. Public Health **8**, 2020 (14).

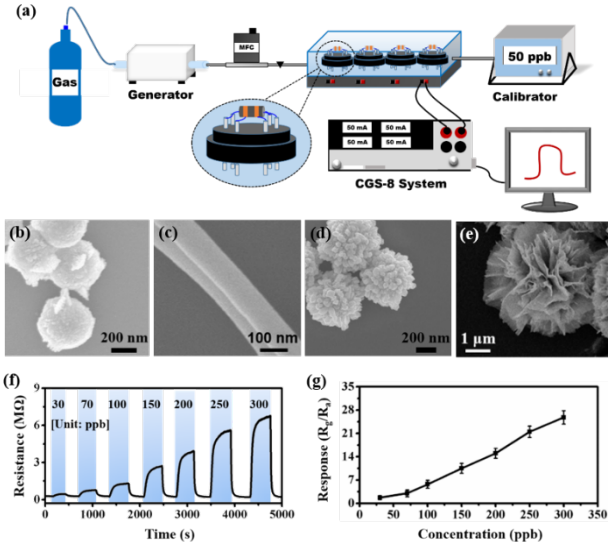

Fig. 1. (a) The O_3 dynamic distribution system. (b-e) SEM images of In_2O_3 nanomaterials applied in O_3 gas sensing. (f) Sensing transients regarded to the sensor based on In_2O_3 (30-300 ppb). (g) Relationship between responses and different O_3 concentrations.