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Highly methane responsive nanosensor layer based on mesoporous nanostructured belts-like Indium Oxide

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This work focuses on development of mesoporous 1-D belt-like In2O3 nanostructures derived from a single-step electrospinning method as an effective approach to produce active sensing layers based on In2O3 with high active surfaces to make full use of the sensing activity of all nanostructures. The annealing temperature effect on methane sensing behavior of these belt-like In2O3 nanostructures was further evaluated. Structural, surface area and porosity as well as surface defects analysis were performed to gain more insight pertaining to the observed gas sensing trends arising from annealing temperature variation. The In2O3 sensor produced at an annealing temperature of 550 ℃ displayed the highest sensitivity of 0.011 ppm, lowest limit of detection of 2 ppm and faster response-recovery times of 36 and 44 s under low operating temperature of 100 ℃. Findings from detailed analysis demonstrated that enhanced sensing capability towards methane in this case stems from synergistic effects of the higher surface area and the larger proportion of the intrinsic surface defects. Further, 1-D belts-like nanostructures of In2O3 composed of small-sized particles offered large active surface area and formed well aligned porous structure for the diffusion of methane gas molecules into and/or out of the sensing film thus contributing to enhanced sensor performance. The mesoporous 1-D belt-like In2O3 nanostructures with high surface area and excellent sensing properties demonstrates a promising application in gas sensor for monitoring and detecting methane released in the agricultural sector.

Apply to be considered for a student ; award (Yes / No)?

Yes

Level for award;(Hons, MSc, PhD, N/A)?

PhD

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