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Chemiresistive semiconductor metal oxide hollow fibers for gas sensing applications

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Chemiresistive semiconductor metal oxide hollow fibers for gas sensing applications: Semiconductor metal oxide-based nanostructures have shown their potential in energy storage device, optoelectronic, photocatalysis and bio/gas sensing applications. The chemiresistive gas sensors fabricated using metal oxides have proven their potential by means of their detection ability towards different toxic gas molecules with higher selectivity. The one-dimensional metal oxide nanostructures such as nanowires, nanorods, nanofibers and hollow structures have shown better detection ability of gaseous molecules due to their higher surface area. Moreover, the size of nanomaterials of the order of Debye length is promising to achieve higher resistance modulation during adsorption and desorption of gaseous species. The synthesis of hollow structures is advantageous compared to their bulk counterparts, as higher surface provided for incoming gas molecules is effectively promotes the resistance modulation and enhance sensor response. These features of metal oxides based gas sensors make them promising and reliable for detection of gaseous species up to part per billion concentration. However, the synthesis of nanostructures of the size less or nearly equal to the Debye length is highly difficult. The electrospinning is a versatile tool for synthesis of nanofibers. On the other hand, atomic layer deposition is a highly efficient technique for deposition of controlled and uniform thin film over irregular surfaces. In this work, we have synthesized hollow fiber, where the polymer nanofibers sued as a template and followed by deposition metal oxide layer by atomic layer deposition technique. The effect of wall thickness and a hole diameter of hollow fiber on gas sensing ability will be discussed in detail.

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