Detection of p-cresol as a body gas marker for Kidney disorder by WO_3 nano-structural patterned gas sensor

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In recent decades, biomarker gas detection has become crucial for early disease diagnosis and environmental monitoring. Various VOCs, such as acetone for diabetes, are key indicators of physiological and pathological states, necessitating reliable detection methods. Among these, p-cresol is a significant biomarker for chronic kidney disease (CKD) [1]. Monitoring these biomarkers in exhaled breath or skin gas is vital for early detection and management. Skin gas sensors, in particular, offer non-invasive, continuous monitoring, providing real-time data without the discomfort of blood tests. Traditional metal oxide semiconductor (MOS) gas sensors are valued for their high sensitivity, compact size, and affordability [2], but they suffer from poor selectivity and characteristic drift. Our study addresses these issues by introducing a highly sensitive WO_3 nano-structural patterned sensor, developed through PLD and lithography processes, optimized for detecting p-cresol, thus enhancing accurate health monitoring.

Figure 1(a) shows the schematic representation of fabricated WO_3 nanowire gas sensor towards p-cresol gas molecules. Figure 1(b) shows the X-ray Diffraction (XRD) patterns of WO_3 thin films (thickness=~100nm) deposited at 200°C~600°C using a pulsed laser deposition method. The results indicated that thin film deposited at 500 °C and 600 °C, showed sharp peaks of (200), indicating optimal crystalline formation. Fig 1(c) demonstrates the gas response of the WO_3-based sensor to exposures of p-cresol and acetone. The sensor exhibits a distinct gas response towards 100 ppm of p-cresol at 300 °C, as depicted by the black curve, which shows a rapid increase in resistance. In our study, we are further modifying the sensor to enhance its response to p-cresol, aiming for higher sensitivity and selectivity in detecting this specific biomarker.

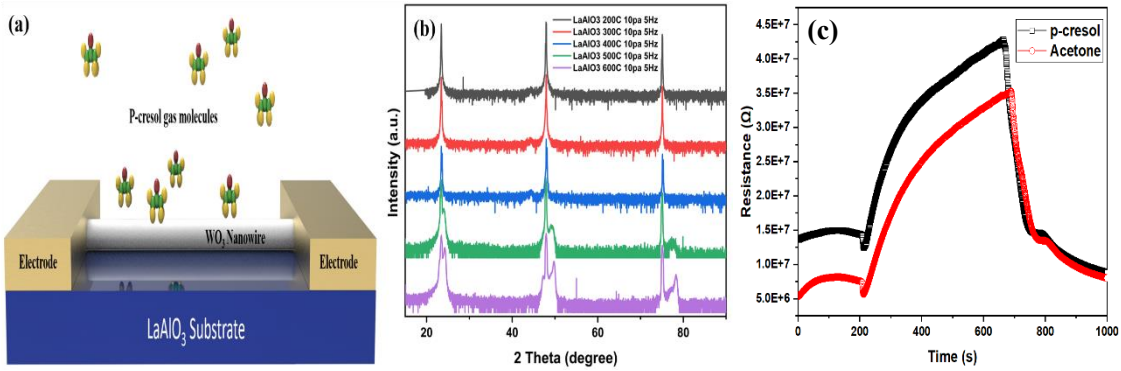

Fig.1(a) Schematic representation of fabricated WO_3 gas sensor, (b) XRD patterns of WO_3 thin films at different deposition temperatures. (b). (c) Response curves showing the sensor's performance in detecting p-cresol and acetone.

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