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Serendipitous p- to n-type response switching in β-Ga2O3 needles: A potential application to selective CO and CH4 gas sensors

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Highly selective sensors that can sense at least two gases are necessary for less expensive, effective, and reliable monitoring of air quality. Conventionally, selectivity is achieved by improving sensor response towards selected target gas. This study suggests the use of materials with unique response switching to achieve selective sensing. Monoclinic β-Ga2O3 needle-like structures were investigated for sensing towards CO and CH4 gases. Interestingly, β-Ga2O3 displays abnormal transitions between p- and n-type response towards CO and CH4, as a function of target gas concentration and the operating temperature. A mechanism is proposed to explain these temperature/concentration – dependent p-n transitions and provide suggestions on how to control them. The switching from p- to n-type sensing in β-Ga2O3 carry great potential for selective recognition and sensitive detection of trace levels of CO and CH4 with good stability. Besides, this p- to n-type switching may also lead to interesting possibilities for tailoring the electronic properties of β-Ga2O3 nanostructure-based devices.

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

Yes

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

PhD

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