

Re-examining Mechanisms, Materials and Measurement in Metal Oxide Gas Sensing

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Abstract:

Despite widespread deployment of metal oxide semiconductor gas sensors, fundamental assumptions about how these devices operate, age and respond to complex gas environments can be poorly described. This talk will present a coherent body of work that revisits core gas sensing paradigms by combining operando spectroscopy, controlled sensing studies and critical analysis of prevailing models, by focusing on the mechanistic origins of the conductometric response in tin dioxide-based sensors. Using operando near-ambient pressure X-ray photoelectron spectroscopy (NAP-XPS) coupled with simultaneous electrical measurements, we demonstrate that dynamically changing surface and near-surface oxygen vacancy populations, rather than ionosorbed oxygen species, are likely to dominate the sensing response. These observations challenge long standing ionosorption based models and provide a more physically grounded framework linking surface stoichiometry to electronic transport.

Keywords:

Operando, XPS, mechanism, oxygen vacancy, tin dioxide

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