

Accelerating Gas Sensor Material Development

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Abstract:

The identification of optimal sensing materials is essential for advancing selective chemiresistive gas sensors [1]. This work presents a high-throughput platform based on spark ablation technology for the rapid discovery and optimization of gas sensor materials. Spark ablation is a fully dry, environmentally friendly process that produces highly pure nanoparticles without chemical precursors, resulting in pristine nanoporous sensing layers. Its versatility enables the synthesis of pure metals, alloys, and doped semiconductors, offering broad compositional flexibility. Using the VSP-P1 nanoprinter, nanoparticles are directly deposited onto a platform chip in a single step, enabling the fabrication of both nanoporous sensing layers [2]. The platform chip is integrated with an active learning loop that can iteratively optimizes key sensing metrics of a gas sensor. As a case study, we targeted formaldehyde detection at ppb concentrations while evaluating specificity against CO, CO₂, toluene, and a hydrocarbon mixture. The results demonstrate that material composition strongly influences sensing performance, enabling the identification of sensors with high specificity and sensitivity toward formaldehyde after only a few iterations. This approach demonstrates the potential of combining spark ablation with active learning as an efficient platform for accelerating gas sensor material discovery and enabling rapid implementation in sensor fabrication.

Keywords:

Gas Sensors, Nanoparticles, Spark Ablation, Dry Printing, Active Learning Loop.

References:

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