
**STEVENS INSTITUTE OF TECHNOLOGY**
**DEPARTMENT OF MECHANICAL ENGINEERING**

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# *Combustion Synthesis of $SnO_2$ Nanocomposites for Gas Sensing Applications*

**Smitesh Bakrania**
Ph.D. Candidate
Combustion Laboratory, University of Michigan

Environmental monitoring is rapidly becoming a necessity with stringent emission standards being enforced. Tin dioxide ($SnO_2$) is an excellent candidate for such applications, however along with high sensitivity, improved gas selectivity is required for large-scale deployment. $SnO_2$ sensing performance can be dramatically improved by decreasing the average particle size and/or by adding metal dopants to the sensing film. We have developed a combustion synthesis facility that combines both the approaches in a single process to generate nanocomposite materials. $SnO_2$ primary particles with average particle sizes of 6-14 nm and nanocomposite systems of gold-, aluminum-, palladium-, and copper-$SnO_2$ were demonstrated and characterized. We have also successfully synthesized $SnO_2$ nanorods using this approach. Our current work focuses on investigating sensing behavior of the combustion-generated nanopowders, looking specifically at sensitivity and time response of $SnO_2$ film sensors to 500 ppm carbon monoxide. Preliminary results indicate a significant dependence of the sensing behavior on film deposition method and composite microstructure. Our sensors have shown appreciable sensor performance compared to commercial powders, as well as remarkable sensitivity to 10 ppm CO concentrations. As these prototype sensors are not optimized, the results are promising in terms of the potential for improving sensor performance using a cost effective, highly scalable synthesis approach.

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**Smitesh Bakrania** is a graduate student in the final year of his Ph.D. degree at University of Michigan under the advisement of Professor Margaret Wooldridge. He has had 6 journal publications so far that include 3 from his undergraduate career. He is also an author of a book chapter on *Functional Nanomaterials*. During his undergraduate career at Union College in Schenectady, NY he worked on Thermochromic Liquid Crystals and Aerogel fabrication that resulted in two separate patent applications – one of which was recently granted.

*For more information, please contact Prof. Frank Fisher at Frank.Fisher@stevens.edu or 201-216-8913*