Nanoscale aluminum doped ZnO synthesized by programmed co-precipitation as a functional material for VOCs detection.

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The concentration of dopant in semiconductors applied as chemical sensors plays a crucial role in its performance and should be carefully adjusted, often at the level of a few atomic percent.

Here we explore the synthesis of aluminum doped zinc oxide (*x*%Al:ZnO, *x* = 0.5, 1.0, 1.5, 2.5, and 5.0%) by programmed co-precipitation to ensure the high-precision chemical composition of this material.

We found that depending on aluminum concentration, the rate of addition of ammonia solution to facilitate intermediate product precipitation, and the solution temperature, the size of the *x*%Al:ZnO changes from tens of nanometers to several micrometers; the shape of the particles varies from globular nanoparticles to nano-, and microrods. We also observed a variation in the crystallite size (29-65 nm) and crystal lattice parameters in wide ranges.

The obtained material demonstrated a high chemiresistive response to VOC vapors (acetone, ethanol, and benzene) mixed with dry air, e.g., up to 0.75±0.02, 0.51±0.03, and 0.25±0.017 to 1 ppm at 250 °C, respectively, and a low sensor-to-sensor variation.

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