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# Highly Selective and Sensitive Detection of Methylbenzenes via Concurrent Control of the Gas Reforming and Filtering in Catalytic Oxide Overlayer.

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**Abstract**

A $Co_3O_4$ gas sensor coated with catalytic oxide overlayer was fabricated by screen printing of $Co_3O_4$ yolk-shell spheres on the substrate and subsequent deposition of $SnO_2$ or $TiO_2$ catalytic overlayer by e-beam evaporation. $Co_3O_4$ gas sensors with $TiO_2$ and $SnO_2$ overlayer (thickness: 5 nm) showed high responses (resistance ratios) to 5 ppm xylene (14.5, 28.8) and 5 ppm toluene (11.7, 16.2) at 250 °C and exhibited excellent selectivity against other interfering gases such as ethanol, HCHO, CO, and benzene. In contrast, the pure $Co_3O_4$ gas sensor did not show high selectivity toward any specific gas. The excellent selectivity to methylbenzenes was attributed to catalytic reforming of less reactive methylbenzene into more reactive and smaller species and catalytic oxidation of reactive interference gases such as ethanol and HCHO at catalytic overlayer. These concurrent tuning of the gas reforming and oxidative filtering processes using a nanoscale catalytic oxide overlayer provides a new, general, and effective method for fabricating highly selective and sensitive metal oxide semiconductor gas sensors.

**Key words:** $Co_3O_4$ gas sensor, methylbenzenes, catalytic overlayer, gas reforming, gas filtering