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Gas Sensing Response of Nickel Doped Calcium Copper Titanate Thin Films Synthesized by Sol-gel Method

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Nickel-doped calcium copper titanate (CaCu₃Ti₄O₁₂: CCTO) thin films were synthesized by a sol-gel method. All films were spin-coated with four layers on silicon and alumina substrates, and each film layer was annealed at a fixed annealing temperature of 800 ℃. The obtained samples with different doping concentrations (0-7.27 wt%) were characterized by X-ray diffraction (XRD), field emission scanning electron microscope (FE-SEM), energy dispersive X-ray spectroscopy (EDX), and X-ray photoelectron spectroscopy (XPS). From XRD patterns, CCTO and Ni-doped CCTO films were cubic perovskite phase with small amount of impurity phases of TiO₂. The film thickness of approximately 320-600 nm were obtained using FE-SEM. In addition, 7.27 wt% Ni-doped CCTO film showed more porosity than other films. The film gas sensors were probed to measure gas sensing responses towards different types of gases such as NO₂, H₂, NH₃, H₂S and ethanol gas. All samples performed the best selectivity towards H₂S. Compared with other films, the 7.27 wt% Ni-doped CCTO film sensors exhibited the highest response of 112 for 10 ppm of H₂S with the optimum temperature of 250 ℃.

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