Contribution ID: **249** Type: **Poster**

Modification of Calcium Copper Titanate Thin Films by Adding Ag Compounds and their H2S Gas Sensing Response

Wednesday 24 May 2017 15:45 (15 minutes)

Ag-doped CaCu₃Ti₄O₁₂ (CCTO) thin films with different doping concentrations were prepared by a sol-gel technique. Films were grown by depositing four layers of CCTO on alumina substrates followed by sputtering Au/Cr interdigitated electrodes to fabricate gas sensors. The films were characterized by X-ray diffraction (XRD), field emission scanning electron microscopy (FESEM) and energy dispersive X-ray spectroscopy (EDX). The films have predominantly the perovskite CCTO crystal phase with very small amount of TiO₂ secondary phases. In this work, both undoped CCTO and Ag-doped CCTO thin films were tested for selective sensing to H₂S gas relative to NH₃, H₂, NO₂ and ethanol vapor. For characterizing gas sensing properties of the films, gas concentrations in the range of 0.2-10 ppm were used with operating temperatures ranging from 150 to 350 ℃. When compared to undoped CCTO sensor, the Ag-doped CCTO sensors presented much higher response. The best sensitivity towards H₂S was found in 0.9 wt% Ag-doped CCTO film and at the optimum operating temperature of 250 ℃. The highest response of the sensor based on the 0.9 wt% Ag-doped CCTO film to 10 ppm of H₂S is approximately ten times than that of a sensor based on undoped CCTO film. The doped film sensor also showed stability and relatively short response and recovery times. Therefore, Ag-doped CCTO films with small doping concentration constitute an excellent candidate for developing H₂S sensors operating at low-temperatures.

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Session Classification: Poster Presentation I

Track Classification: Surface, Interface and Thin Film