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The microwave properties of tin sulfide thin films prepared by RF magnetron sputtering techniques

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Abstract

In this paper we present the microwave properties of tin sulfide (SnS) thin films with the thickness of just 10 nm, grown by RF magnetron sputtering techniques on a 4 inch silicon dioxide/high-resistivity silicon wafer. In this respect, interdigitated capacitors in coplanar waveguide technology were fabricated directly on the SnS film to be used as both phase shifters and detectors, depending on the ferroelectric or semiconductor behaviour of the SnS material. The ferroelectricity of the semiconducting thin layer manifests itself in a strong dependence of the electrical permittivity on the applied DC bias voltage, which induces a phase shift of 30 degrees mm^{-1} at 1 GHz and of 8 degrees mm^{-1} at 10 GHz, whereas the transmission losses are less than 2 dB in the frequency range 2–20 GHz. We have also investigated the microwave detection properties of SnS, obtaining at 1 GHz a voltage responsivity of about 30 mV mW^{-1} in the unbiased case and with an input power level of only 16 μW.

Keywords: ferroelectrics, microwaves, semiconductors, thin films, tin sulfide, detector, phase shifter

(Some figures may appear in colour only in the online journal)

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