VO_x Thin Film for Uncooled Microbolometer Application

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Abstract

Over the past 20 years, the most commonly used sensor technology for IR imaging is the uncooled bolometer, commonly referred to as microbolometers. Bolometers work by absorbing infrared radiation, which increases their temperature and changes their electrical characteristics, such as resistance. The most widely used sensitive materials for microbolometers are VO_x thin films [1]. Since the vanadium atom has a half-filled d-shell, there exists a set of valence states to form a number of oxide phases. The typical phases of VO_x are VO, V_2O_3, VO_2, and V_2O_5. Various deposition methods, such as CVD, reactive e-beam evaporation, and sputtering, can be used to fabricate VO_x thin films. In the present work, the RF-sputtering technique is used to grow a VO_x thin film. The V_2O_5 target was sputtered onto the predefined IDE pattern on glass substrates (refer to Fig. (b)). Sputtering parameters, such as temperature, deposition time, and power, were optimised to obtain defect-free VO_x thin films [2]. The temperature coefficient of Resistance (TCR) is a key parameter, as the microbolometer's output signal depends directly on the TCR of the sensing material. We achieved TCR values of -2.578%/K for the developed VO_x thin films (see Fig. (a)) [3]. A number of VO_x thin films were fabricated to test the repeatability of TCR values. Further fine-tuning of the composition to maximise sensitivity is under development.

References

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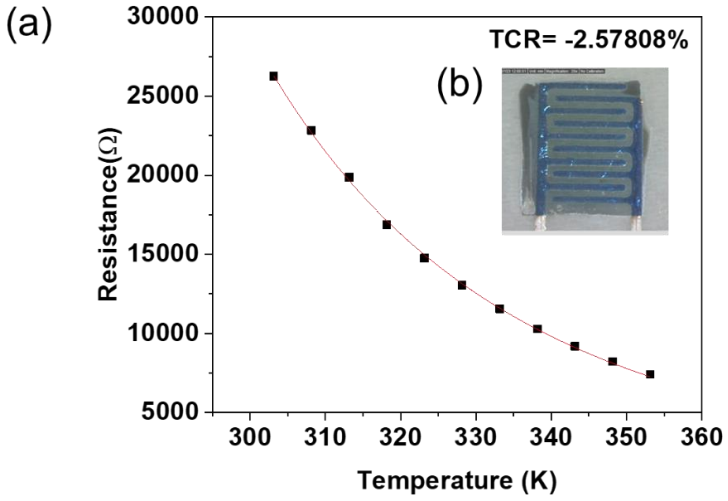
[2] Deepak Raj, P., Gupta, Sudha, Sridharan M. Materials Science in Semiconductor Processing, 39, (2015), 426–432
[3] Bin Wang, Jianjun Lai,Hui Li, Haoming Hu, SihaiChen. Infrared Physics and Technology, 57 (2013) 8-13

Figures



Figures: (a) TCR graph of VO_x thin film **(b)** VO_x thin film sputtered on IDE pattern