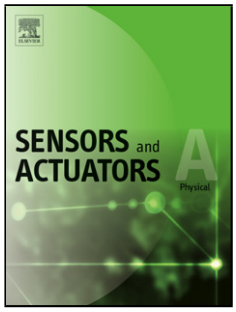

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Low cost and anti-noise infrared device based on saw-tooth thermal isolation structure

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Highlights

1: We remove the resistor *Rg* of the infrared device based on composite film to reduce the cost.

2: We proposed a saw-tooth thermal isolation structure.

3: We investigated the thermal insulation performance and anti-noise of the structure. The saw-tooth thermal isolation structure not only has good thermal insulation performance but also good anti-noise performance.

4: Our device has excellent electro properties, such as *Rv*, *NEP* and *D**.

Abstract:

The low cost composite film pyroelectric infrared device with novel saw-tooth thermal isolation structure is reported in this paper. The pyroelectric sensor was fabricated by using PZT/ P(VDF-TrFE) composites. The *Rg* of the voltage-mode readout-circuit was removed to reduce the cost. Use PCB V-cut process to fabricate saw-tooth thermal isolation structure to improve anti-noise performance of the device. The device that using improved readout-circuit and saw-tooth thermal isolation structure was prepared. The voltage responsivity (*Rv*), noise equivalent power (*NEP*) and detectivity (*D**) of the device were calculated, the modulation frequency was 2.3 Hz-117.3 Hz.

Keywords：pyroelectric infrared device; readout-circuit; thermal isolation structure; PZT/P(VDF-TrFE).

1. Introduction

Infrared device has been deeply studied since the early 21st century due to its applications in human body detection [1], gas detection [2], energy harvesting detection [3]. The main parts of the infrared device are sensor, readout-circuit and thermal isolation structure. In order to reduce the cost of device, the pyroelectric material has been intensively studied [4, 5] which was used to fabricate sensor. Pyroelectric composite material has received great attention due to low cost and combines both the advantages of pyroelectric ceramic and polymer material [6]. The preparation process of pyroelectric composite is simple and shows excellent figure of merit (FOM) value [7, 8]. PZT/P(VDF-TrFE) is one of the most intensively studied material system.

Most commercial sensors are based on ceramic materials due to their high pyroelectric constant. But the preparation process of the composites is simple and the preparation temperature is very low. In order to improve the detective sensitivity of the device based on composites, one should decrease the heat capacity and thermal conductivity of the pyroelectric materials. But the cost of infrared device based on composite is more expensive due to the high resistance resistor *Rg* in readout-circuit. The thermal isolation structure has been extensively studied, but the traditional structure only considers the