Sensors and Materials, Vol. 26, No. 2 (2014) 75–83
MYU Tokyo

S & M 0972

Fabrication and Characterization of Thermoelectric Microgenerators with Carbon Nanotube

Chun-Chia Yeh, Ching-Liang Dai* and Hsi-Fu Shih

Department of Mechanical Engineering, National Chung Hsing University,
Taichung, 402 Taiwan, R.O.C.

(Received June 10, 2013; accepted September 26, 2013)

Key words: thermocouple, thermoelectric generator, CMOS, carbon nanotubes

In this paper, we present the fabrication and characterization of a thermoelectric microgenerator. The thermoelectric microgenerator is composed of 370 thermocouples in series, and each thermocouple is formed by p-type and n-type polysilicon strips. The output power of the microgenerator depends on the temperature difference between hot and cold parts of the thermocouples. To increase the output power of the microgenerator, the hot part of thermocouples is designed as a suspended structure, and multiwalled carbon nanotubes (MCNTs) are coated on the microgenerator. The thermoelectric microgenerator was fabricated using the standard 0.18 μm complementary metal oxide semiconductor (CMOS) process and a postprocess. The postprocess uses reactive ion etching (RIE) to release the suspended hot part structure of the microgenerator. The finite element method software, ANSYS, is employed to simulate the temperature distribution of the microgenerator. The experimental results show that the microgenerator with MCNTs has an output voltage per area of 0.18 $mV \cdot mm^{-2} \cdot K^{-1}$.

*Corresponding author: e-mail: cldai@dragon.nchu.edu.tw