課題番号　　:F-16-UT-0030
利用形態　　:機器利用
利用課題名(日本語)　　:
Program Title (English)　:Development of Electret-based Unsteady Thermal Energy Harvester
利用者名(日本語)　　:謝　鴻, 鈴木　雄二
Username (English)　　:H. Xie, Y. Suzuki
所属名(日本語)　　:東京大学大学院工学系研究科機械工学専攻
Affiliation (English)　　:Department of Mechanical Engineering, The University of Tokyo

## 1. 概要(Summary)

An electret-based unsteady thermal energy harvester is proposed using potassium tantalate niobate ($KTa_{1-x}Nb_xO_3$, KTN) as a dielectric for the capacitor. By connecting in series the capacitor and an electret serving as a permanent voltage source, the capacitance change with temperature fluctuations alters the amount of induced charges thereby produces the external current. By using KTN having extremely-large temperature coefficient of permittivity together with the CYTOP electret, the output power of 572 nJ has been obtained from one heating cycle, which corresponds to 20 times higher output power than the previous result with $BaTiO_3$.

## 2. 実験(Experimental)

【利用した主な装置】

ブレードダイサー　DAD3650(汎用)

【実験方法】

A TEMPAX glass wafer was first sputtered with electrodes and CYTOP. Then the whole plate is cut by the blade dicer to obtain two electret chips.

## 3. 結果と考察(Results and Discussion)

Fig. 1 shows the result of TSD experiment. The stored charge density for the CYTOP electret is estimated to be 53 nC/m$^2$, which corresponds to the surface voltage of $V_{charge}$ = 43 V. Fig. 2 shows the output voltage with the external load of 610 MΩ. With the heating rates of 1.74 °C/s and 0.98 °C/s, the output power of 572 nJ and 363 nJ have been obtained, respectively. With the heating rate of 1.74 °C/s, the output power is 20 times higher than that in our previous study [1].

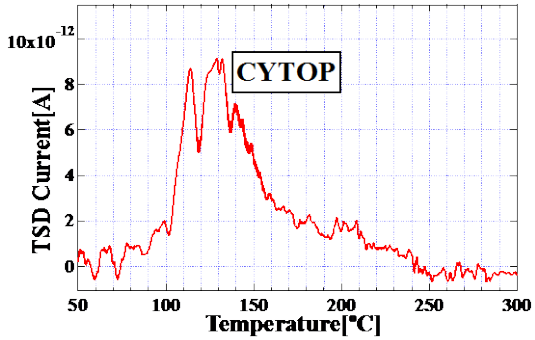


Fig. 1: TSD spectra of the charged electret.

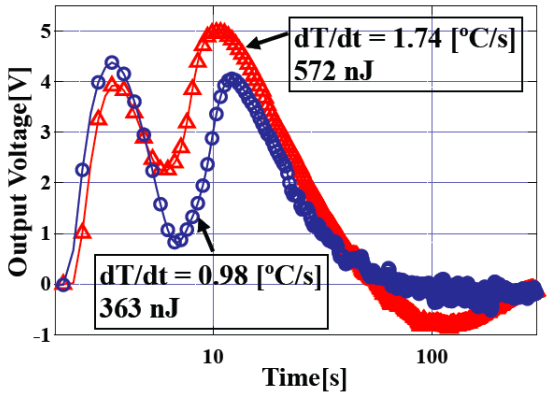


Fig. 2: Output voltage during a single heating cycle.

## 4. その他・特記事項(Others)

参考文献:[1] J. Yoshida et al., J. Phys. Conf. Ser., Vol. 476, 12079 (2013).

## 5. 論文・学会発表(Publication/Presentation)

(1) H. Xie, K. Morimoto, and Y. Suzuki, 16th Int. Workshop on Micro and Nanotechnology for Power Generation and Energy Conversion Applications (PowerMEMS 2016), Paris, (2016). Also, J. Phys. Conf. Ser., Vol. 773, 012023 (2016).

(2) 謝鴻, 森本賢一, 鈴木雄二, 日本機械学会熱工学コンファレンス 2016, 松山, 2016 年 10 月 22 日-10 月 23 日, H123.

## 6. 関連特許(Patent)

なし