課題番号　　:F-17-UT-0070
利用形態　　:機器利用
利用課題名(日本語)　　:
Program Title (English)　　: Electrostatic Unsteady Thermal Energy Harvester Using Nematic Liquid Crystal
利用者名(日本語)　　:謝鴻, 森本賢一, 鈴木雄二
Username (English)　　:H. Xie, K. Morimoto, 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
キーワード／Keyword　　:Nematic Liquid Crystal, Thermal Energy Harvesting、切削、研磨、接合

1. 概要(Summary)

A novel electrostatic unsteady thermal energy harvester using nematic liquid crystal is proposed to get higher temperature sensitivity of our unsteady thermal energy harvester [1]. With relative high anisotropic permittivity, low clearing temperature and relatively high resistivity, fluorinated nematic liquid crystal BCH-5F.F.F. is chosen for temperature-sensitive dielectric. Output voltage from the temperature change is recorded and compared with an effective circuit mode. The liquid crystal cell is an essential part of the experiment setup for applying voltage for property characterization and power generation experiment.

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】

For initial test, we first sputtered ITO on the TEMPAX glass wafer and diced with DAD3650 for target cell design. Liquid crystal cell was fabricated with two substrates with spacers.

3. 結果と考察(Results and Discussion)

The working principle of our liquid crystal is based on phase transition of nematic liquid crystal as shown in Figure 1. After filling the liquid crystal into the cell, we measured the axial and transverse permittivity while heating the cell. Figure 2 shows the permittivity change during heating. As temperature increases, significant permittivity change has been obtained, which leads to the present power generation.

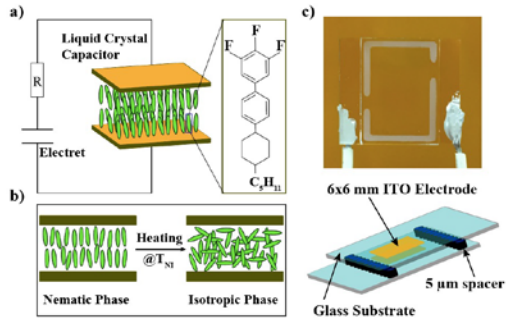

Figure 1 a) LC-based unsteady thermal harvester b) Phase transition of nematic LC c) Structure of LC cell

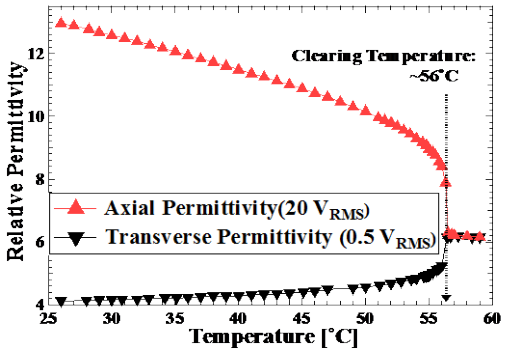

Figure 2 Permittivity change of BCH-5F.F.F.

4. その他・特記事項(Others)

参考文献:[1] H. Xie et al., J. Phys. Conf. Ser., Vol. 773, 012023 (2016).

5. 論文・学会発表(Publication/Presentation)

(1) H. Xie, K. Morimoto, and Y. Suzuki, 17th Int. Workshop on Micro and Nanotechnology for Power Generation and Energy Conversion Applications (PowerMEMS 2017), Kanazawa, (2017). (Best Paper Award)

6. 関連特許(Patent)

なし