

課題番号 : F-15-UT-0074
利用形態 : 機器利用
利用課題名(日本語) :
Program Title (English) : In-plane Gap-closing MEMS Vibration Electret Energy Harvester on Thick BOX Layer
利用者名(日本語) : 付 乾炎, 鈴木 雄二
Username (English) : Qianyan Fu, Yuji 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 improved in-plane electret energy harvester with gap-closing comb drives has been developed with a single-mask SOI process. By increasing the seismic mass and reducing the parasitic capacitance, up to $5.3 \mu\text{W}$ output power, which is five times higher than our previous prototype and reaches as high as 45% of the VDRG limit, has been obtained at 503 Hz.

2. 実験(Experimental)

【利用した主な装置】

高速大面積電子線描画装置 F5112 + VD01、光リソグラフィ装置 MA-6、気相フッ酸エッチング装置、ステルスダイサー、マニュアルウエッジボンダー、機械特性評価装置

【実験方法】

The device was fabricated through the silicon-on-insulator (SOI) MEMS technology (Fig. 1). $150 \mu\text{m}$ -thick device layer is etched with DRIE to form springs, electrodes and etched holes. Then, the buried oxide layer is etched with vapor HF for releasing the structure through the etched holes on the seismic mass. This is followed by a $1.5 \mu\text{m}$ -thick Parylene-C deposition as the electret material. Finally, soft X-ray charging using 9.5 keV acceleration voltages is applied with the bias voltage of 130 V for 150 seconds.

3. 結果と考察(Results and Discussion)

Fig. 2 shows output power versus vibration frequency. Up to $5.3 \mu\text{W}$ output power, reaching as high as 45% of the VDRG limit, has been obtained at 503 Hz.

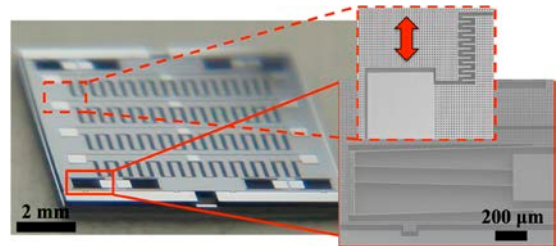


Fig. 1 Fabricated device.

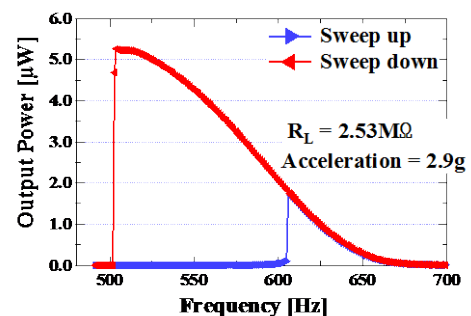


Fig. 2 Output power versus vibration frequency.

4. その他・特記事項(Others)

なし

5. 論文・学会発表(Publication/Presentation)

- (1) Q. Fu, Y. Suzuki, "In-plane Gap-closing MEMS Vibration Electret Energy Harvester on Thick BOX Layer," 18th Int. Conf. Solid-state Sensors, Actuators, and Microsystems (Transducers '15), Anchorage, (2015), pp. 1925-1928.
- (2) Q. Fu, Y. Suzuki., "MEMS Vibration Electret Energy Harvester with Combined Electrodes," 27th IEEE Int. Conf. Micro Electro Mechanical Systems (MEMS'14), San Francisco (2014), pp. 409-412.

6. 関連特許(Patent)

なし