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Micro Power Generator with High-performace Polymer Electret

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I. Introduction

Electrostatic-induction generator using electrets was proposed three decades ago [1,2], but recently it attracts much attention for micro power generation [3, 4]. Since the relative speed of rotor/oscillator in micro generators is small, electrostatic induction should be superior to electromagnetic one. In our previous studies, we have proposed high-performance perfluoropolymer electret using CYTOP™ [4, 5], and obtained up to 0.7 mW from 20Hz oscillation with an amplitude of 1.2 mm_{p-p}. We have also developed MEMS parylene high-aspect-ratio springs [6] that realize low resonant frequency and large in-plane amplitudes. In this report, our recent progress on the development a micro electret power genarator is presented.

II. Micro Electret Generator

Figure 1 shows the micro seismic electret generator developed using MEMS technologies. Dimensions of the device is 3 x 3 cm^2. The top Si substrate is composed of a proof mass (14.6x16 mm^2) supported with parylene high-aspect-ratio springs (Fig. 2). Patterned electrets and electrodes are formed both on the Si mass and the substrate. The width of the patterned electret and electrodes is 150 μm.

III. Experimental Result

We employ CYTOP™ (CTL-809M, Asahi Glass) as the electret material. The surface voltage of electret on the top substrate is -560 V, and that of the bottom substrate is -450 V. The gap between the electret and the electrode is 170 μm.

The resonant frequency of the mass-spring system is 37Hz, and in-plane amplitude at the resonance is as large as 1 mm. In a preliminary experiment, we have obtained 21 V_{p-p} output voltage with a 100MΩ external load.

IV. Conclusion

Vibration-driven electret generator has been developed with the aid of MEMS technologies. Parylene high-aspect-ratio spring is successfully microfabricated to support an in-plane seismic mass. Resonant frequency as low as 37Hz has been achieved with a large in-plane amplitude of 1 mm. With our early prototype, we have obtained 21 V_{p-p} voltage output.

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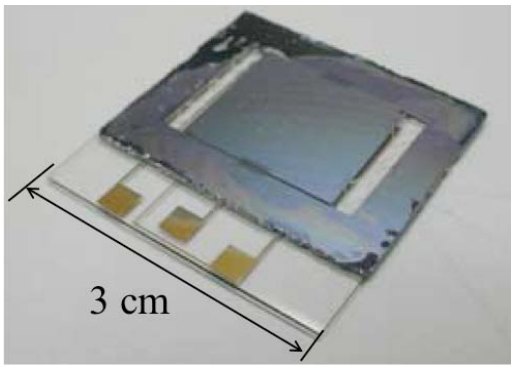

Figure 1. Prototype micro electret generator.

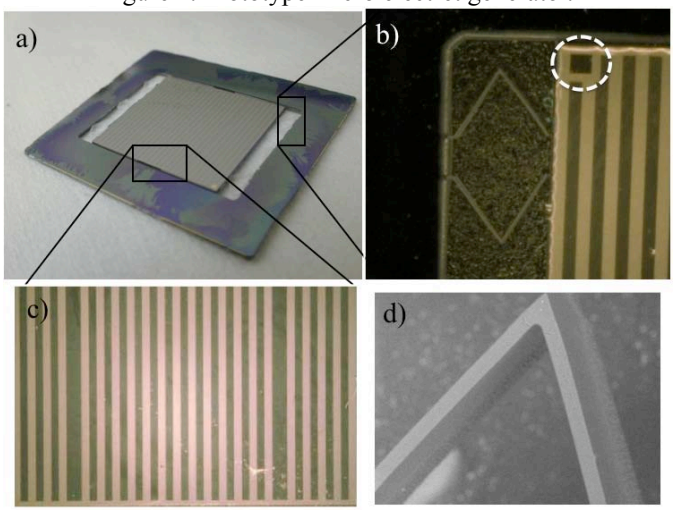

Figure 2. Reverse side of the top structure, a)Overview, b, c)Patterned electret on the seismic Si mass, and parylene high-aspect-ratio spring, d)SEM image of the parylene spring.