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Characterizationof Micro Power Generator Using a Gold Electroplated Coil and Magnet at Low Frequency

Dong Ho Lee[1,2], Chang Woo Lee[1], Seong-Il Kim*[2], Yoon Pyo Lee[2]
[1]Department of Nano & Electronic Physics, Kookmin University, Seoul, Korea, 136-702
[2]Semiconductor Materials and Devices Lab., Korea Institute of Science & Technology, P.O. Box 131, Cheongryang, Seoul, Korea, 130-650
*Corresponding author: s-ikim@kist.re.kr, Phone: +82 2 958 5706, Fax: +82 2 958 5739

We fabricated a spiral winding coil structure on a pyrex 7740 glass wafer by using electroplating, which is one of the important techniques in microelectromechanical (MEMS) technology. We fabricated a self-power generating device using an electroplated coil and a permanent magnet, and characterize the obtained electrical energy as a function of vibration frequency. We have designed and fabricated a measurement system which convert a rotational motion of a motor into a linear motion like a vibration motion. The purpose of this work is to develop a self power generating device which convert the ambient vibrational or oscillating energy into useful electrical energy. With changing the vibrational frequency from 0.5 Hz to 8 Hz, the generated power increased linearly. The generated voltage was 139 mV at 4 Hz and 263 mV at 8 Hz. After using the step up circuit, the measured voltage was 130 mV at 4 Hz and 370 mV at 8Hz. From above the frequency of 4.5 Hz, the gain obtained by using the quadrupler circuit become larger than the loss without using that circuit.

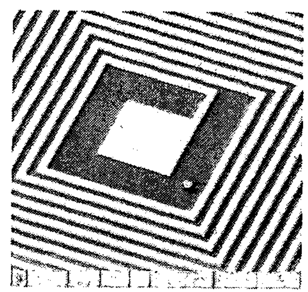

Fig. 1. SEM pictures of the fabricated gold electroplated coil structure

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Novel Actuator with Flat Movable Part for Optical Pickup Head

Chau-Yuan Ke*[1], Ruey-Shing Huang[2]
[1]Electronics and Optoelectronics Research Laboratories, Industrial Technology Research Institute, 310 Rm. 309, Bldg. 78, No. 195, Sec. 4, Chung Hsing Rd., Chutung, Hsinchu, Taiwan
[2]Institute of Electronics Engineering, National Tsing Hua University, 300 No. 101, Sec. 2, Kuang Fu Road, Hsinchu, Taiwan
*Corresponding author: kecy@itri.org.tw, Phone: +886-3-5918072, Fax: +886-3-5917531

Compact size and tilt-controllable function are two main trends in designing optical pick-up heads [1-3]. A tilt-controllable actuator with a novel structure was designed and verified in this work, and the results of the frequency response tests done with the prototypes corresponded with the simulation results. The reading tests done by using a pick-up head with the actuator designed in this work proved the feasibility of this design.

The structure of this newly-designed actuator is shown in Fig. 1. The movable part of this actuatoris suspended by four metallic wires. It comprises a PCB as its lens holder, and there are three sets of coils made of copper foil on the PCB. The three sets of coils include the first focusing coils, the second focusing coils, and tracking coils. The tilt-controlling torquecomes from the force difference between the first and second sets of focusing coils. The flat shape of the movable part of this actuator has the advantage of being applied to design an ultra-slim actuator.A prototype for feasibility verification was made, and its size is 26.7mm×20.0mm×6.7mm. It has movable ranges of ± 0.7 mm in focusing direction, ± 0.7 mm in tracking direction, and ± 1.7 degrees in radial tilting direction. Optimization of the magnetic circuit and the structural modal analysis were done by applying commercial FEM software. The simulated frequency response characteristics as well as the experimental results expressed in Bode plots are shown in Fig. 2. The experimental results and the simulation ones quite corresponded.

This actuator was further applied to a DVD pick-up head to conduct reading tests. Fig. 3 shows an S-curve and an eye pattern, both of which are the reproduced information from an optical disc by this pick-up head. The reading test verified that the actuator is feasible to be used in optical pick-up heads.

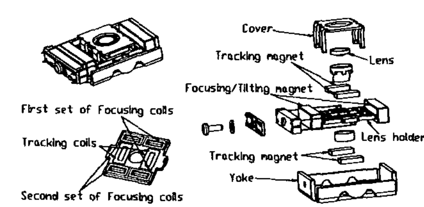
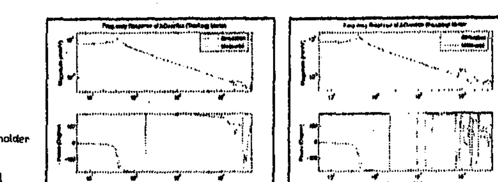


Fig. 1. Drawing of this newly-designed actuator



(a) Tracking direction (b) Focusing direction

Fig. 2. Bode plots of frequency response tests

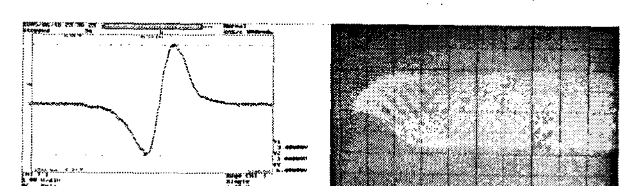


Fig. 3. S-curve and eye pattern from a pick-up head applying this actuator

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