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UV-LIGA Microfabrication of a Power Relay Based on Electrostatic Actuation

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ABSTRACT

Most micro-sized switches (micro-relays) currently on the market or reported in the literature are solid-state devices made using semiconductor technology, with the silicon predominant material. Such devices typically have low current capacity, low off-resistance, significant on-resistance, significant power consumption, and low dielectric strength. In recent years, the fast-evolving technology of microelectromechanical system (MEMS) has opened up new opportunities for microfabricating microelectromechanical switches [Petersen, 1982, and Sakata, 1989]. However, most of the MEMS relays are based on silicon fabrication and can not be used for power applications.

In this study, our approach is as follows: a UV-LIGA microfabrication, an operating property test, and a dynamic analysis and simulation of a new type of power micro-relays based on electrostatic actuation.

Our relays will be microfabricated with SU-8 thick resist based UV-LIGA technology. LIGA microfabrication technologies have the unique advantages of producing high aspect-ratio microstructures of polymer, metals and alloys [Rogge et al, 1995]. The x-ray LIGA provides better quality and is more expensive. UV-LIGA, based on thick resist (SU-8) photolithography, provides slightly lower quality and much lower fabrication cost. It also provides great potential for building microstructures from a broad selection of materials. The combination of a broad material selection and the capability of making high aspect ratio microstructures make the technology best suited for fabricating microelectromechanical power relays.

We will test the operating properties of our fabricated relays. These relays should have the following characteristics: fast switching speed, high power capacity, high off-resistance, lower on-resistance, and low power consumption and heat generation.

FIGURES AND TABLES

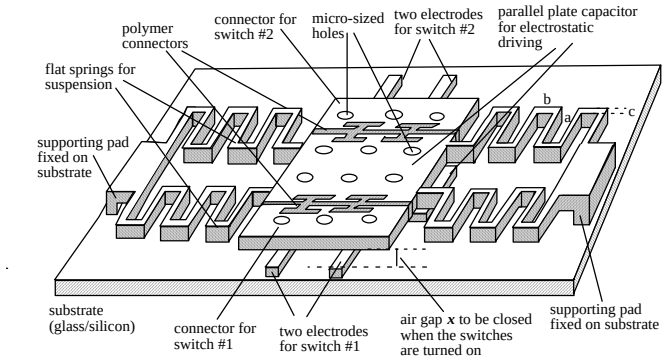

Figure 1: The schematic design diagram for the micro power relay. In this basic design, the switch can be used to control two channels, one in the front and one in the back.

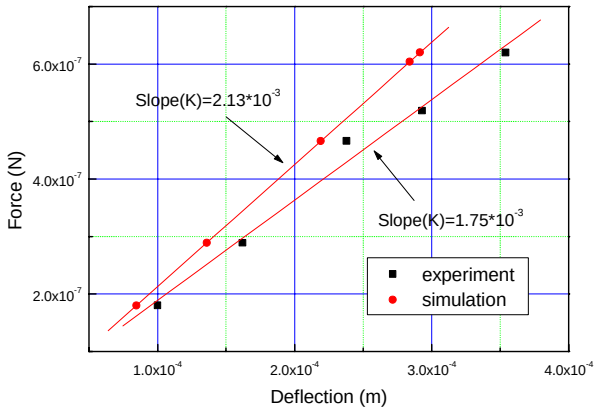

Figure 2: A simple preliminary test results; experimental spring constant: 1.75×10^{-3} and simulation spring constant: 2.13×10^{-3}

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