Polymeric thermal microactuator with embedded silicon skeleton: Part II- Fabrication, characterization, and application for 2-DOF microgripper

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Abstract: This paper presents the fabrication, characterization, and application of a novel silicon-polymer laterally stacked electrothermal microactuator. The actuator consists of a deep silicon skeleton structure with a thin-film aluminum heater on top and filled polymer in the trenches among the vertical silicon parts. The fabrication is based on deep reactive ion etching, aluminum sputtering, SU8 filling, and KOH etching. The actuator is 360 μm long, 125 μm wide, and 30 μm thick. It generates a large in-plane forward motion up to 9 μm at a driving voltage of 2.5 V using low power consumption and low operating temperature. A novel 2-D microgripper based on four such forward actuators is introduced. The microgripper jaws can be moved along both the χ- and γ -axes up to 17 and 11 μm, respectively. The microgripper can grasp a microobject with a diameter from 6 to 40 μm. In addition, the proposed design is suitable for rotation of the clamped object both clockwise and counterclockwise. © 2008 IEEE.

Author Keywords: 2-D microgripper; Electrothermal microactuator; Polymeric microactuator; SU8

Index Keywords: Actuators; Alumina; Aluminum; Cantilever beams; Etching; Grippers; Light metals; Microactuators; Nonmetals; Optical design; Polymers; Reactive sputtering; Silicon; 2-D microgripper; Aluminum sputtering; Deep reactive ion etching; Driving voltages; Electro thermal micro actuators; Electrothermal microactuator; Forward motion; In-plane; KOH etching; Low operating temperature; Low-power consumption; Micro Grippers; Polymeric microactuator; Silicon skeleton; SU8; Reactive ion etching

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