Electrothermal microgripper with large jaw displacement and integrated force sensors

Chu Duc T., Lau G.-K., Creemer J.F., Sarro P.M.

Faculty of Electronics and Telecommunication, College of Technology, Vietnam National University, Hanoi, Viet Nam; School of Mechanical and Aerospace Engineering, Nanyang Technological University, Singapore 639798, Singapore; Electronic Components, Technology and Materials Laboratory, Delft Institute of Microsystems and Nanoelectronics, Delft University of Technology, 2628 CT Delft, Netherlands

Abstract: The novel design of a sensing microgripper based on silicon-polymer electrothermal actuators and piezoresistive force-sensing cantilever beams is presented. The actuator consists of a silicon comb structure with an aluminum heater on top and filled polymer in between the comb fingers. The sensor consists of a silicon cantilever with sensing piezoresistors on top. A microgripper jaw displacement up to 32 μm at a 4.5-V applied voltage is measured. The maximum average temperature change is 176 °C. The output voltage of the piezoresistive sensing cantilever is up to 49 mV at the maximum jaw displacement. The measured force sensitivity is up to 1.7 V/N with a corresponding displacement sensitivity of 1.5 kV/m. Minimum detectable displacement of 1 nm and minimum detectable force of 770 nN are estimated. This sensing microgripper can potentially be used in automatic manipulation systems in microassembly and microrobotics. [2008-0064]. © 2008 IEEE.

Author Keywords: Electrothermal actuator; Microgripper; Piezoresistive sensor; Polymeric actuator; Sensing microgripper

Index Keywords: Actuators; Alumina; Electrostatic actuators; Microactuators; Polymers; Sensors; Silicon; Electrothermal actuator; Microgripper; Piezoresistive sensor; Polymeric actuator; Sensing microgripper; Grippers

Year: 2008
Source title: Journal of Microelectromechanical Systems
Volume: 17
Issue: 6
Page : 1546-1555
Cited by: 13
Link: Scopus Link
Correspondence Address: Chu Duc, T.; Faculty of Electronics and Telecommunication, College of Technology, Vietnam National University, Hanoi, Viet Nam; email: trinhcd@vnu.edu.vn
ISSN: 10577157
CODEN: JMIYE
DOI: 10.1109/JMEMS.2008.2007268
Language of Original Document: English
Abbreviated Source Title: Journal of Microelectromechanical Systems
Document Type: Article
Authors with affiliations:

- Chu Duc, T., Faculty of Electronics and Telecommunication, College of Technology, Vietnam National University, Hanoi, Vietnam
- Lau, G.-K., School of Mechanical and Aerospace Engineering, Nanyang Technological University, Singapore 639798, Singapore
- Creemer, J.F., Electronic Components, Technology and Materials Laboratory, Delft Institute of Microsystems and Nanoelectronics, Delft University of Technology, 2628 CT Delft, Netherlands
- Sarro, P.M., Electronic Components, Technology and Materials Laboratory, Delft Institute of Microsystems and Nanoelectronics, Delft University of Technology, 2628 CT Delft, Netherlands

References:


• Feng, R., Farris, R.J., Influence of processing conditions on the thermal and mechanical properties of SU8 negative photoresist coatings (2003) J. Micromech. Microeng, 13 (1), pp. 80-88. , Jan


