Electrothermal microgripper with large jaw displacement and integrated force sensors

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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.

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