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Feasibility Study of PDMS-based Thermal Microactuators

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In this paper, we describe the design, fabrication and characterization of new microactuators for a microelectromechanical system that requires a large displacement. The designed microactuators use the thermal expansion power of a transparent polymer, polydimethylsiloxane (PDMS), which has a high coefficient of thermal expansion. The locomotive mechanism of the microactuator is based on the motion of an inchworm. Various structures of the PDMS part are designed to find an optimal shape that provides the largest deformation for a given power. The structure of a microactuator with 1 mm length and 350 μm width is also optimized by numerical analysis using ANSYS. After the microfabrication of three different microactuators, several properties are evaluated by applying a thermal power generated from a heating source. The experimental results are in good agreement with the simulation results. One of the fabricated microactuators has a maximum displacement of about 725 μm.

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