Design, Fabrication, and Performance of a Piezoelectric Uniflex Microactuator

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Abstract: Microactuators provide controlled motion and force for applications ranging from radio frequency switches to microfluidic valves. Large amplitude response in piezoelectric actuators requires amplification of the small strain, exhibited by the piezoelectric material, used in the construction of such actuators. This paper studies a uniflex microactuator that combines the strain amplification mechanisms of a unimorph and flexural motion to produce large displacement and blocking force. The design and fabrication of the proposed uniflex microactuator are described in detail. An analytical model is developed with three connected beams and a reflective symmetric boundary condition that predicts actuator displacement and blocking force as a function of the applied voltage. The model shows that the uniflex design requires appropriate parameter ranges, particularly the clear, between the unimorph and aluminum cap, to ensure that both the unimorph and flexural amplification effects are realized. With a weakened joint at the unimorph/cap interface, the model is found to predict the displacement and blocking force for the actuators fabricated in this work. [2008-0128]