

ABSTRACT:

This paper reports the wireless control of bulk-micromachined shape-memory-alloy actuators using external radiofrequency magnetic fields and its application to microgrippers. The frequency-sensitive wireless resonant heater to which the gripper actuator is bonded is activated only when the field frequency is tuned to the resonant frequency of the heater. A batch-compatible bonding technique based on photo-defined copper electroplating is developed to mechanically and thermally couple the gripper with the planar heater circuit fabricated using copper-clad polyimide film. The actuation range of 600 μm as the tip opening distance is obtained with normally closed 5-mm long grippers at a device temperature of 92 $^{\circ}\text{C}$. The field frequency range to which the devices with 140-MHz resonant frequency respond is measured to be ~ 13 MHz about the resonant frequency. The manipulation of vertically aligned carbon-nanotube forests is experimentally demonstrated. Mechanical stress tests for the bond formed by the developed electroplating bonding method show a shear strength greater than 40 MPa.