Large Deflection Micro-electromechanical System Switch for Power Application

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Micro-electromechanical system switch technology is an alternative for the power system switch application due to their low and high performance. These switches have the advantages of low on resistance, high breakdown voltages and are of small area.

This presentation describes the design of a surface micro-electromechanical actuator with large deflection by using four masks. Lorentz force is used to actuate the switch which requires low power consumption. The relation between the on state resistance and the off state breakdown voltage is studied. The on state resistance depends on the resistance between the metal contacts and it strongly depends on contact force, Young’s modulus, roughness and cleanliness. The off state breakdown voltage depends on contact gap and depends on the field emission and ionic gas discharge between the contact.

In this work, the structure of our switch consists of a bimetallic U-shaped beam of aluminum and chromium metal. To have a stiff structure silicon oxide is used as the contact beam and thereby it isolates conductivity and aluminum is used as the contact. The thin chromium film acts as a stressed metal over the aluminum, so by releasing the sacrificial layer the beam curves at an angle giving a large deflection before the actuation. The switch remains in the closed position by an electrostatic force and it is released by reversing the current through the U-beam. Our switch design will be further developed and modeled for high power applications.