Micro-Scale Electrochemically Actuated Capillary Lens

by

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ABSTRACT

Manipulating the shape of liquids using surface tension is an important and useful technology in designing small-scale fluidic devices. This thesis presents a micro-scale variable focal length liquid lens consisting of two capillary surfaces. Two generations of devices have been fabricated using MEMS fabrication technologies. Surface tension is made to change one capillary surface relative to the other by means of an electric voltage that works in conjunction with a redox surfactant (FTMA). The change in curvature of the capillary surfaces induces a change in focal length in a process that is reversible. Focal length values are between -60 μm and 460 μm depending on the volume and they follow closely theoretical predictions for pure water microlens. Electrochemical activation can change the focal length of the MEMS lens by 40% or more. Pinning becomes more critical for the devices using electrochemically active water solutions. Time response of the order of 30s has been demonstrated.