DESIGN AND SIMULATION OF A MEMS STRUCTURE FOR ELECTROPHORETIC AND DIELECTROPHORETIC SEPARATION OF PARTICLES BY CONTACTLESS ELECTRODES

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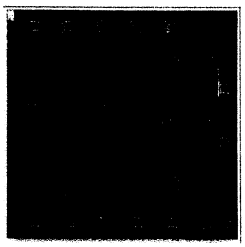
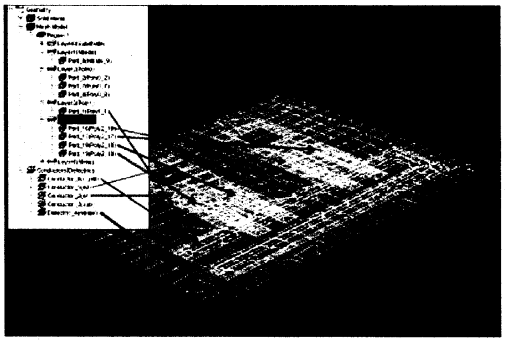
Rapid identification of pathogenic bacterial species is an important factor in combating public health problems such as E. *coli* contamination. Food and waterborne pathogens account for sickness in 76 million people annually (CDC). Diarrheagenic *E. coli* is a major source of gastrointestinal illness. Severe sepsis and Septicemia within the hospital environment are also major problems. 751,000 cases annually with a 30-50% mortality rate (Crit Care Med, July '01, Vol. 29, 1303-10). Patient risks run the continuum from fever to organ failure and death. Mis-diagnosis or inappropriate treatment increases mortality. There exists a need for rapid screening of samples for identification of pathogenic species (Certain *E. coli* strains are essential for health). Critical to the identification process is the ability to isolate analytes of interest rapidly.

This poster discusses novel devices for the separation of particles on the basis of the dielectric properties, mass and surface charge characteristics is presented. Existing designs involve contact between electrode surfaces and analyte medium resulting in contamination of the electrode bearing elements Two different device designs using different bulk micromachining MEMS processes (PolyMUMPS and a Pyrex®/Gold electrode design) are presented. These designs cover a range of particle sizes from small molecules through eucaryotic cells. The application of separation of bacteria is discussed in detail. Simulation data for electrostatic and microfluidic characteristics are provided. Detailed design characteristics and physical features of the as-fabricated PolyMUMPS design are provided. Analysis of the simulation data relative to the expected performance of the devices will be provided and subsequent conclusions discussed.

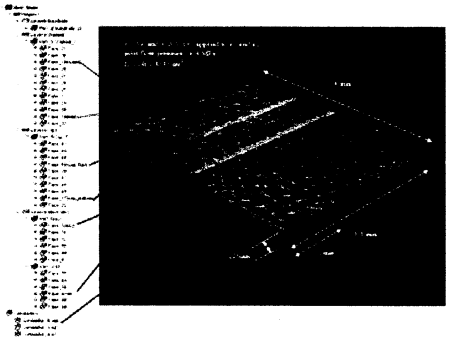


Memscap Test Device



MEMS Simulations

Lab-on-chip Design



Microfluidic Simulations