Title: BI-DIRECTION RAPID ACTION ELECTROSTATICALLY ACTUATED MICROVALVE

Abstract: A bi-directional electrostatic microvalve includes a membrane electrode (12) that is controlled by application of voltage to fixed electrodes (10, 14) disposed on either side of the membrane electrode Dielectric insulating layers (10ii, 10iv, 16, 18, 12vl, 12vi, 4iii, 4iv) separate the electrodes. One of the fixed electrodes defines a microcavity (24) Microfluidic channels formed into the electrodes provide fluid to the microcavity A central pad (28) defined in the microcavity places a portion of the second electrode close to the membrane electrode to provide a quick actuation while the microcavity reduces film squeezing pressure of the membrane electrode. In preferred embodiment microvalves, low surface energy and low surface charge trapping coatings, such as fluorocarbon films made from cross-linked carbon di-fluoride monomers or surface monolayers made from fluorocarbon terminated silanol compounds coatings coat the electrode low bulk charge trapping dielectric layers.

FIG. 1A
INTERNATIONAL SEARCH REPORT

International application No
PCT/US 06/29296

A CLASSIFICATION OF SUBJECT MATTER
IPC(8) - F 16 K 31/02 (2008.04)
USPC - 251/129.01

According to International Patent Classification (IPC) or to both national classification and IPC

B FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC(8) - F 16 K 31/02 (2208 04)
USPC - 251/129 01

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
IPC(8) - F 16 K 31/02 (2008.04) - see keyword below
USPC - 251/129 01, 137/625 48, 862, 870, 417/322, 413 1, 413 3, 62 - see keyword below

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
PubWEST (USPT, PGPB, EPAB, JPAB), Google Scholar/patent
Search Terms Used Microvalve, electro, dielectric, fluid, electrostatic, voltage, pressure, open, close, membrane, diaphragm, surface charge trapping, pad, cavity, microcavity

C DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No</th>
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D Further documents are listed in the continuation of Box C

T later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
X document of particular relevance, the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
Y document of particular relevance, the claimed invention cannot be considered to involve an inventive step when the document is taken alone and combined with one or more other such documents, such combination being obvious to a person skilled in the art
K document member of the same patent family

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