L NEMS/MEMS Technology and Devices

ICMAT 2009

International Conference on Materials for Advanced Technologies 2009

AND

IUMRS - ICA 2009

International Union of Materials Research Societies-International Conference in Asia 2009

28 June - 3 July 2009, Singapore

Suntec Singapore International Convention & Exhibition Centre

www.mrs.org.sg

Organised by

MRS Materials Research Society SINGAPORE

In association with

NUS National University of Singapore

Institute of Materials Research and Engineering A*STAR

NANYANG TECHNOLOGICAL UNIVERSITY

Symposium L

NEMS/MEMS Technology and Devices

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Scope of Symposium

The emphasis of this symposium is on Nanoelectromechanical Systems (NEMS)/Microelectromechanical Systems (MEMS) technology and devices. Particularly applications that involve MEMS design, modeling, fabrication processes (e.g. semiconductors, polymers, etc.) lab-on-a-chip, and biophotonic medical devices (e.g. DNA, protein and cell sorting, etc.) are preferred. This symposium will explore new devices and processes innovation and engineering applications, especially related to NEMS/MEMS technology and devices.

Symposium Topics

- Theory, Design, Analysis of MEMS and NEMS
- Materials and Device Characterization
- Fabrication Technologies
- Packaging and Assembly Technology
- Mechanical and Physical Sensors
- Chemical Sensors and Microsystems
- BioMEMS and Fluidic Systems
- Actuators and micro-structure modeling
- Optical MEMS and nanophotonic (PBG, QD and plasmonics)
- RF MEMS devices and switching circuits
- Sensing System, Algorithm and Sensor Networks
- Nanotechnology and NEMS Devices
- Lab-on-a-chip and uTAS devices
- Plasmonic MEMS and devices

Contents

A00808-01418

Exploring the Innovational Potential of Biomimetics for Novel 3D MEMS

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For MEMS and NEMS technologies, macroscopic best practice in terms of, for example, lubrication and surface topography cannot be scaled down linearly. Effects of adhesion, stiction and contamination by third bodies, which are swamped by bulk continuum phenomena at the macroscale, become dominant at the micrometer length scale. Currently, the MEMS and NEMS industry puts great effort into investigating tribology on the micro- and nanometre scale. Novel three dimensional MEMS such as piezoelectric inkjet printer parts, accelerometers in cars for airbag deployment in collisions, gyroscopes used in modern cars to trigger dynamic stability control, disposable blood pressure sensors, or the several hundred thousands of digital micromirrors in a beamer would exhibit increased performance as soon as their tribology were optimized.

Diatoms are single-celled organisms that generally multiply by cell division. One of the best-known properties of the diatom cell is that it is contained in a shell of amorphous hydrated silica, SiO2 . 2 H2O. It is known from the fossil record that colony formation by means of rigid linking structures in relative motion has a long history in the diatoms: there are impressive examples of sister valves remaining attached through linking structures in fossil deposits as many as 50 million years old. Diatoms already have well adapted and elaborate tribological properties on the micro- and nanometer length scale and, therefore, can provide valuable ideas and templates for optimized MEMS and NEMS.

The BioScreen project analyses the rich flora in South East Asia concerning its biomimetic inspirational potential for technological applications. A central aspect in the implementation of the project is the cooperation between institutions in the European Union with local institutions in South East Asia. Increasing awareness about the technological innovation potential of the rainforest and its abundance of species might cause a paradigm shift in the way locals view virgin forests. BioScreen is a pilot project with one major task: the installation of collaborations between key institutions that shall then serve as base for further projects.

In course of the BioScreen Project, diatoms and further organisms that are present in impressive species abundance in the tropical rainforest are thoroughly screened for their innovational potential for novel 3D MEMS. First results of the screening study will be presented.

A00858-01626

Compatibility Study of Diamond-like Nanocomposite Thin Films with Hydrazine Propellant for MEMS Microthruster

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In microelectronics fabrication, the deposition of thin films has been a key processing step, because of their versatile applications in masking, isolation and passivation layers. With the advancement of technology for MEMS (Micro-Electro-Mechanical Systems) technology, further research for growth and development of thin film materials are need of the day for possible application in chemical, biological, micro-fluidic or inertial sensors or actuators. Pertaining to silicon MEMS based micro-thruster application it has been noted that silicon cannot tolerate very high internal pressure or heavy mechanical shocks. In case of silicon MEMS based micro propulsion system; physical and chemical compatibility of different propellants with silicon poses restriction on the choice of propellants in terms of unwarranted surface reaction.

For space applications, hydrazine is widely used as a propellant due to high specific heat and stability factors; on the other hand, hydrazine is a popular choice as an etching agent for silicon. In conventional metal body thruster where etching by hydrazine is not an issue, where as the direct contact of hydrazine in silicon MEMS thruster is a problem. Hence in order to develop a silicon MEMS microthruster it is necessary to study a protective passivation layers. Diamond like nano composite (DLN) thin film as a potential protective coating has been studied extensively in this work. A thorough investigation of etch rates of the DLN films deposited on silicon for various concentration of hydrazine (N_2H_4) at different temperatures and its chemical compatibility have been carried out and reported.

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