

Microparticles separation using MEMS and Microfluidics

Burhanuddin Yeop Majlis
Institute of Microengineering and Nanoelectronics (IMEN)
Universiti Kebangsaan Malaysia (UKM)
43600 UKM Bangi, Selangor

E-mail: burhan@ukm.edu.my

In this paper we present a simple, low cost fabrication of a microfilter and separation technique using in different applications of Lab on Chip. Silicon MEMS is explored in microporous membrane fabrication, namely copper electroplating and electrochemical etching (ECE) of silicon. In the first technique, a copper membrane with evenly distributed micropores was fabricated by electroplating the copper layer on the silicon nitride membrane, which was later removed to leave the freestanding microporous membrane structure. The second approach involves the thinning of bulk silicon down to a few micrometers thick using KOH and etching the resulting silicon membrane in 5% HF by ECE to create micropores. A UV-curing elastomeric polyurethane methacrylate (PUMA) for rapid prototyping of microfluidic devices is introduced. An elastomeric microfluidic device consisting of parallel arrays of pillars with mechanically tunable spacings is employed as an adjustable microfiltration platform. The tunable filtration system is used for finding the best conditions of separation of solid microbeads or deformable blood cells in a crossflow pillar-based method. The DEP with 2D electrode structure was fabricated and characterized to see the effect of electrode structure configuration on the capture capability of the cells suspending in the solution. The presented microelectrode array structures are made of planar conductive metal structure having same size and geometry.

Keywords—Lab-on-Chip, Microfluidics, PUMA, Microfilter, Micropores.



BRIEF BIOGRAPHY

Burhanuddin Yeop Majlis is a Professor of Microelectronics at the Department of Electrical, Electronics and Systems Engineering, Universiti Kebangsaan Malaysia (UKM); The National University of Malaysia. He received his Ph.D. in Microelectronics from University of Durham, United Kingdom in 1988, MSc in Microelectronics from University of Wales, UK in 1980, and BSc(Hons.) in Physics from UKM in 1979. He

was the Deputy Dean of UKM's Engineering Faculty from 1995 until 1997. He was also a Research Fellow at the Telekom Malaysia (TM) Research & Development Division, and was the Director of the UKM-TM Microelectronics Research Centre at the Faculty of Engineering, UKM. He was responsible in developing and planning the setting up of the class 1000 and 100 clean room for research at UKM. He had attended intensive industrial training in GaAs MMIC design and manufacturing at GEC-Marconi Material Technology Ltd. United Kingdom.

Currently, He is a Senior Member of the Institute of Electrical and Electronics Engineers (IEEE) and was the Chairman of the IEEE Electron Devices Malaysia Chapter from 1994 to 2006. He is a member of the Institute of Engineering and Technology (IET). He is also a Fellow Member of the Malaysian Solid State Science and Technology (FMSSS). He initiated research in microfabrication and microsensors at UKM in 1995 and has also initiated research in GaAs technology with Telekom Malaysia. In 2001 he started research in MEMS with substantial research funding of US\$10 million from the Ministry of Science, Technology and Innovation. His current interest are design and fabrication of MEMS sensor, RFMEMS, BiOMEMS, Lab on Chip and microenergy and is now the program leader for MEMS research, a National Strategic Research Program. Dr Burhan has published four text books in electronics and one book on Integrated Circuits Fabrication Technology for undergraduate courses and more than 550 academic research papers. His involvement in IEEE and Chair of the Electron Devices Malaysian Chapter for 13 years have given a high impact in the area of semiconductor and microelectronics in Malaysia. His contribution in research activities in this area is very significant. He has initiated a number of research activities in microelectronics and MEMS in Malaysia. He can be considered as a pioneer of MBE-related research in Malaysia via collaborative research with Telekom Malaysia. As a result of his active involvement in IEEE EDS Malaysia, the Chapter is the recipient of the prestigious 2014 EDS Region 10 Chapter of the Year Award.

Dr Burhan is the founder of the first science and engineering-based research institute at UKM, called the Institute of Microengineering and Nanoelectronics (IMEN) in 2002 and has been the Director of IMEN, UKM until now. Under his able leadership, IMEN has been recognized as one of the Centre of Excellence (CoE) of UKM and has been awarded the Nano Malaysia Centre of Excellence by the Ministry of Science, Technology and Innovation (MOSTI) in 2011. Recently, in 2014, IMEN was awarded the Higher Institution Centre of Excellence (HiCOE) with research funding of US\$1 million/year by the Malaysian Ministry of Education (MOE) in the niche field of MEMs for Biomedical (Research Focus: MEMs in Artificial Kidney) which is one of UKM's research strength. He chair the Nanotechnology and Advanced Material Research Niche in UKM which comprises of 34 research groups across science and engineering faculties. He has also founded an association to gather all research in nanotechnology in Malaysia, and in 2009, the Malaysian Nanotechnology Association (MNA) was officially established and he was the Founder President until 2012. He was elected as a Fellow of the Academy of Sciences Malaysia (FASc) in April 2014.