

Silicon nanoporous membranes for dialysis

Enakshi Bhattacharya

Department of Electrical Engineering and Centre for NEMS and Nanophotonics, IIT Madras, Chennai 600036, India

E-mail: enakshi@ee.iitm.ac.in

Abstract

Ultrathin silicon nanoporous membranes (SNMs) can be used for the separation or dialysis of biomolecules. When a thin film of amorphous silicon, sandwiched between two layers of silicon oxide, is subjected to rapid thermal annealing (RTA), multiple pores are spontaneously formed in the amorphous silicon layer. SNMs of 15 nm thickness, with an average pore size of 8 nm, were fabricated using standard batch processes like: silicon bulk micromachining, chemical vapour deposition and RTA followed by reactive ion etching to release the membranes. Most hemodialysis (HD) dialysers remove uremic toxins using polymeric membranes of few μm thickness, with a wide range of pore diameters, leading to tortuous paths and clogging. The ultrathin SNMs, capable of efficiently separating out the uremic toxins, can be a viable alternative to the polymeric membranes for HD. A maximum clearance of 49% urea and creatinine, driven by diffusion, was seen. A lateral array of SNMs, with a laminar flow dialysis apparatus built in-house and use of peristaltic pumping, was found to significantly enhance the clearance rate.

Biography



Name : Enakshi Bhattacharya, PhD
Professor
Department of Electrical Engineering and
Centre for NEMS and Nanophotonics
Indian Institute of Technology Madras
Chennai 600036, India

Phone: 91-44-22574419

FAX:

91-44-22574402

email :

enakshi@ee.iitm.ac.in

enakshi@iitm.ac.in

home page:

<http://www.ee.iitm.ac.in/~enakshi/>

Enakshi Bhattacharya completed her MSc (Physics) from the Indian Institute of Technology Bombay in 1980; PhD from the Tata Institute of Fundamental Research, Mumbai in 1985 and did post-doctoral work at the Solar Energy Research Institute (now the National Renewable Energy Laboratory), USA from 1986-88. She was a faculty member in the Department of Physics, IIT Kanpur during 1988-91. Since 1991, she has been on the faculty of the Department of Electrical Engineering at IIT Madras and chaired the department during 2010-2013. She spent a sabbatical year in 2000 at Analog Devices, USA and a semester at IIT Mandi in 2017. She has played a key role in establishing the Centre for NEMS and Nanophotonics at IIT Madras in 2011 which is now a part of the national Nanoelectronics Network for Research and Applications. Her expertise is in silicon technology and its interdisciplinary applications and her current research areas are in MEMS/NEMS, BioMEMS and Biosensors. She is a Senior Member of the IEEE Electron Devices Society (EDS), a Distinguished Lecturer of the IEEE Sensors Council, and recipient of the Institute of Smart Structures and Systems (ISSS) Distinguished Service Award, 2019. She is a member of the Editorial Board of the IoP J. of Micromechanics and Microengineering, UK.