Bedanta Gogoi et al., J Nanomater Mol Nanotechnol 2018, Volume 7
DOI: 10.4172/2324-8777-C2-023

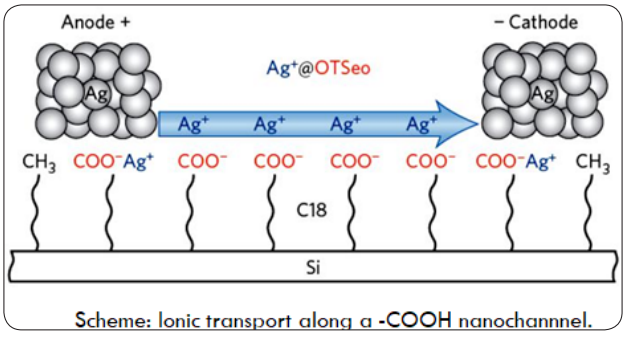
24th World Nano Conference

May 07-08, 2018 | Rome, Italy

Ionic transport through patterned surface nano channels fabricated on self-assembled organosilane monolayers

Bedanta Gogoi, Santanu Talukdar, Rivka Maoz and **Jacob Sagiv**
Weizmann Institute of Science, Israel

Constructive lithography (CL) is a unique tool of chemical surface patterning and nanofabrication which is helpful in better understanding the underlying principles of ionic/electronic transport in a single monolayer or multilayer assembly. CL provides a robust and versatile platform for the design and fabrication of various ionic-electronic cell circuits, data and energy storage devices, etc., which have scientific as well as potential technological applications. Such surface patterning may be performed with electrically biased scanning probes (AFM) or stamps, as well as with focused electron beams using an EBL (electron beam lithography) system. With the help of this method, nano-scale surface channels of carboxyl groups (-COOH) were fabricated on stable self-assembled organosilane monolayers on smooth silicon wafer substrates. In CL, interfacial water bridges mediate the local electrochemical oxidation of top methyl groups (-CH3) of a self-assembled organosilane monolayer to -COOH upon the application of an optimal bias voltage. Macro-, micro- and nano-channels of -COOH functionality has been fabricated using electrically biased stamps or AFM probes. Very long nano-channels with widths of about 20 nm are reproducibly produced with focused electron beams. Such nano-channels exhibit unusual ion transport properties upon the application of a small voltage bias. It was found that the ionic transport in narrow nano-channels of this kind may result in lateral electrochemical growth of electrically conducting metal filaments with a limiting thickness of 1 nm that inhibit further ionic transport along the metal convered path. The schematic representation given below shows the transport of silver ions (Ag+) between electrically biased silver metal electrodes deposited on a -COOH monolayer nano-channel.



Scheme: Ionic transport along a -COOH nanochannnel.

Recent Publications:

1. Berson J, Burshtain D, Zeira A, Yoffee A, Maoz R and Sagiv J (2015) Single layer ionic conduction on carboxyl terminated silane monolayers patterned by constructive lithography. Nature Materials 14(6):613-621.

Biography

Bedanta Gogoi has received his PhD in 2016 from IASST, Gauhati University, India. His doctoral research delved into the synthesis of polymers from bio-based materials for chemosensing applications. Since Novermber 2016 he has been working in the field of monolayer self-assembly and electrical characterization as a Postdoctoral researcher in the group of Professor Jacob Sagiv at the Weizmann Institute of Science, Israel.

bedanta@weizmann.ac.il