Modifying the surface charge of single track-etched conical nanopores in polyimide

Ali M, Schiedt B, Healy K, Neumann R, Ensinger W
NANOTECHNOLOGY 19 (2008) 085713/1-085713/6

Chemical modification of nanopore surfaces is of great interest as it means that the surface composition is no longer fixed by the choice of substrate material, even to the point where large biomolecules can be attached to the pore walls. Controlling nanopore transport characteristics is one important application of surface modification which is very relevant given the significant interest in sensors based on the transport of ions and molecules through nanopores. Reported here is a method to change the surface charge polarity of single track-etched conical nanopores in polyimide, which also has the potential to attach more complex molecules to the carboxyl groups on the nanopore walls. These carboxyl groups were converted into terminal amino groups, first by activation with *N*-(3-dimethylaminopropyl)-*N*-ethylcarbodiimide (EDC) and *N*-hydroxysuccinimide (NHS) followed by the covalent coupling of ethylenediamine. This results in a changed surface charge polarity. Regeneration of a carboxyl-terminated surface was also possible, by reaction of the amino groups with succinic anhydride. The success of these reactions was confirmed by measurements of the pore's pH sensitive current–voltage (*I* –*V*) characteristics before and after the chemical modification, which depend on surface charge. The permselectivity of the pores also changed accordingly with the modification.