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Ion-track Nanotechnology: from bio-inspired nanopores to 3D nanowire networks for energy applications

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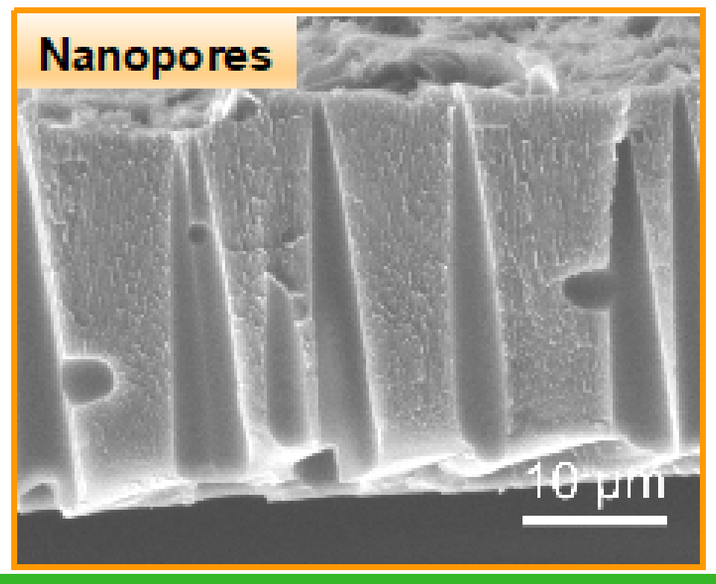
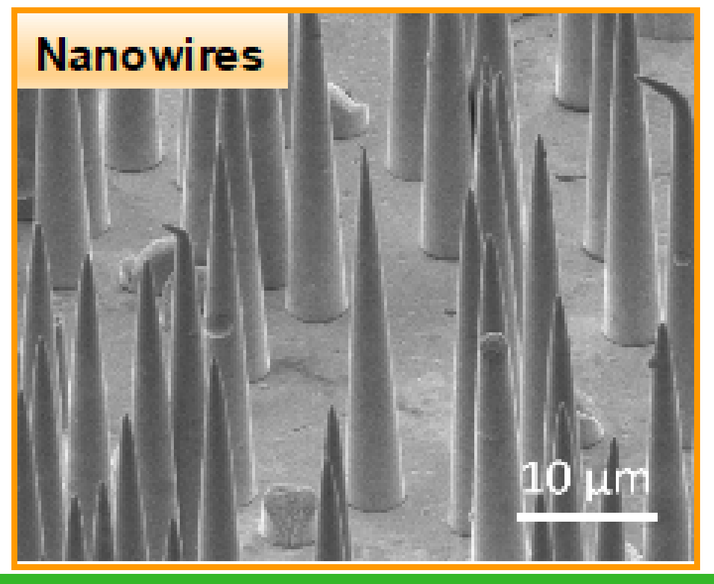
Abstract

At GSI, isoporous membranes with parallel nanochannels are fabricated by swift heavy ion irradiation and subsequent chemical etching. In addition, templates with interconnected tilted nanochannels are obtained by applying ion irradiation at several incident angles in consecutive steps. Nanochannel density and orientation, as well as diameter and geometry, are adjusted by the irradiation and etching conditions, respectively. Carboxyl groups present at the surface of polymer track-etched channels enable the application of further chemical modification steps to functionalize the channel surface, thus rendering bio-inspired selective ion transport properties. Various examples of nanochannels with novel sensor properties will be presented.

Alternatively, subsequent electrodeposition in the membrane channels results in nanowire arrays and highly ordered 3-D nanowire ensembles of various materials including metals (Cu, Au1-xAgx), semiconductors (ZnO and p-Cu2O) and semimetals (Bi1-xSbx). This talk will also illustrate how the unique combination of electrodeposition and tailored nanochannel templates provides an excellent platform to investigate their size-dependent properties, and to develop 3D and multicomponent nanostructure assemblies. The assembly of nanowires into stable 3D architectures is important towards their implementation in e.g. thermoelectric, catalytical, or photoelectrochemical devices.





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