

Material science and nanotechnology with GeV ion beams

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The existing accelerators at GSI and the future facility FAIR (Facility for Antiproton and Ion Research) provide unique opportunities for material science and other interdisciplinary research disciplines. The interest in beams of such high energies is based on the large energy deposition and the severe modification of physical and chemical properties of materials.

The various research activities with GeV ion beams include the simulation of cosmic radiation to investigate astrochemical processes in space as well as irradiations of samples pressurized in diamond anvil cells to test how materials respond under extreme radiation and pressure conditions.

In the field of ion-track nanotechnology, membranes with parallel nanochannels are fabricated by irradiating polymer foils and subsequently convert ion tracks into open channels by chemical track etching. The density and orientation of the nanochannel as well as their diameter and shape are adjusted by the irradiation and etching conditions. Electrodeposition in the channels results in nanowire arrays of various materials including metals, semimetals, and semiconductors. Various examples for applications of tailored nanochannels and nanowires will be discussed.