

## **Materials Research with Energetic Heavy Ions at GSI**

Reinhard Neumann

*Springer Proceedings in Physics 127 (2009) 311-318 ISSN 0930-8989*

Materials research at the Gesellschaft für Schwerionenforschung (GSI) in Darmstadt, Germany, employs the energetic heavy-ion beams from the large accelerators operated by GSI, and encompasses a broad spectrum of basic and applied aspects. This article gives an overview of the main topics and illustrates them with some recent results. Phase transitions have been stimulated in graphite and zircon by simultaneous exposure to high pressure and heavy ions. The damage trails caused by energetic heavy ions along their trajectories in materials such as organic polymers and mica are transformed by chemical etching into channels with diameters down to the nanometer scale. These pores can serve as model systems for biological ion channels and, furthermore, represent promising devices for biosensor applications. Metal and semimetal nanowires have been created by filling etched ion tracks in polymer foils, related studies focusing on electrical, optical, and thermal properties of single nanowires. The heavy-ion microprobe is able to target a sample with a single ion including uranium, having specific kinetic energies up to 12 MeV/amu, with a precision of about 1  $\mu\text{m}$ . Single-ion irradiation of individual cell nuclei in a cell culture is one of the objectives under investigation.