

Self-aligned nanostructures created by swift heavy ion irradiation

Gehrke H-G, Nix A-K, Hofsäss H, Krauser J, Trautmann C, Weidinger A
Journal of Applied Physics 107, (2010) 094305

In tetrahedral amorphous carbon (ta-C) swift heavy ions create conducting tracks of about 8 nm in diameter. To apply these nanowires and implement them into nanodevices, they have to be contacted and gated. In the present work, we demonstrate the fabrication of conducting vertical nanostructures in ta-C together with self-aligned gate electrodes. A multilayer assembly is irradiated with GeV heavy ions and subsequently exposed to several selective etching processes. The samples consist of a Si wafer as substrate covered by a thin ta-C layer. On top is deposited a SiN_x film for insulation, a Cr layer as electrode, and finally a polycarbonate film as ion track template. Chemical track etching opens nanochannels in the polymer which are self-aligned with the conducting tracks in ta-C because they are produced by the same ions. Through the pores in the polymer template, the Cr and SiN_x layers are opened by ion beam sputtering and plasma etching, respectively. The resulting structure consists of nanowires embedded in the insulating carbon matrix with a built in gate electrode and has potential application as gated field emission cathode.