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Modification of carbon nanomembranes and graphene with ions

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Since two-dimensional materials with their unique physical properties have become accessible to experimental physics, the scientific interest in this material class has been very high as they promise a multitude of possible applications. In particular, it has been shown that ionizing particle irradiation allows structuring of these 2d materials [1- 4].

In addition to graphene, so-called carbon nanomembranes (CNMs) also belong to the class of the new two-dimensional materials. They offer the advantage that they can be produced and transferred by standard chemical and physical methods instead of mechanical exfoliation. For this experiment we have prepared single layer graphene as well as CNMs samples. The latter were prepared by electron induced crosslinking of aromatic self-assembled monolayers like biphenylthiol which was evaporated on copper [5,6]. Our samples have been irradiated with swift heavy ions under glancing angles of incidence. The samples were analysed by atomic force microscopy in ambient conditions and in ultrahigh vacuum. The latter measurements served as test measurements for our newly built setup at the M branch of the UNILAC beamline in GSI (Darmstadt, Germany) and were performed in-situ directly after irradiation.

The CNMs show modifications in form of extended pores with shapes different from those which we typically observe in graphene. Finally, experiments performed at different accelerator facilities (GSI, GANIL, and RBI) with different beams energies were used to determine the threshold for pore formation.

References:

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