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Heavy ion-induced gas desorption in accelerators

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In heavy-ion accelerators such as the heavy ion synchrotron SIS18 at GSI, charge exchanged lost beam ions stimulate the release of gas from the chamber walls and the subsequent pressure increase leads to increased or even complete beam-loss. Consequently heavy ion-induced desorption is an issue for next-generation heavy ion accelerators with highest beam intensities.

To come up against dynamic vacuum, several measures have been conducted. In particular the physics behind the ion-induced release of gas was investigated. It could be shown that the desorbed gas is originating mainly from surface-close regions of the target. But in contrast to earlier ideas, sputtering of the oxide layer on metals was not identified as source for desorbed gas.

The contribution summarizes the perceptions gathered to date, including desorption yield studies, materials analysis and modeling of the process. Latest experiments on the annealing of critical components revealed the possibility to minimize the desorption yield by two orders of magnitude. The amount and composition of gas contained in materials was measured by thermal desorption spectroscopy and gives insight into the origin of desorbed gas. At superconducting structures of new accelerators, gas can be accumulated at the surface over time and therefore investigations on desorption of frozen gas ice were started.

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