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Study of the processes of secondary electron emission in diagnostic systems of beams of charged particles and heavy ions of accelerators.

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Today, when developing and creating new accelerators of charged particles and heavy ions, various engineering and technological solutions are used in this area. The most important part of almost all accelerator complexes is the beam monitoring and diagnostics system. This work presents a system for monitoring charged particles and heavy ions, allowing operation in a wide range of energies of accelerated particles. The system allows you to visualize the profile of a beam of protons, deuterons, alpha particles, as well as heavy ions of various energies to determine the position and shape of the beam. The operating principle of the system is based on the use of the effect of secondary electron emission. The system consists of a scanning grid of gold-plated tungsten sensors located inside the accelerator ion guide. The beam particles interact with the sensors and knock out secondary electrons. As a result, each sensor becomes a current generator, and the current is proportional to the beam intensity. By measuring the signal at each sensor, it is possible to reconstruct the beam profile and study the processes of secondary electron emission.
This work presents experimental data obtained at the Unique Scientific Installation (UNU) "Cyclotron of the Physicotechnical Institute named after. A.F. Ioffe type U-120" using beams of 40Ar+8 ions with an energy of 53 MeV. The result of the experiments was the visualization of the profiles of beams of protons, alpha particles and 40Ar+8 ions. Studies were carried out of the parameters of signals from the system's sensors during their interactions with charged particles of the beam. Processing of this information made it possible for the first time to obtain the coefficient of secondary electron emission of 40Ar+8 ions with an energy of 53 MeV during their interaction with the sensor material (tungsten) used in a multi-wire beam monitoring system. This result became the basis for testing the theoretical description of secondary electron emission processes at average energies of charged particles.

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