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INVESTIGATION OF SECONDARY ELECTRON EMISSION PROCESSES USING A MULTI-WIRE MONITORING SYSTEM FOR CHARGED-PARTICLE AND HEAVY-ION BEAMS

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Secondary electron emission is the process of electron emission from the surface of a material (target) under bombardment by beams of charged particles and heavy ions. The study of this process is challenging due to the need for accurate measurements of both the incident beam current and the total current of secondary electrons emitted from the target. Secondary electron emission is a surface process, with a secondary-particle escape depth of approximately 5 nm [1]. Therefore, refractory materials coated with a thin layer of the material under investigation are commonly used as targets. A representative example is a gold-coated tungsten wire, which serves as a sensor. An array of such sensors forms a wire-grid beam profile monitor [2]. The use of this type of detector for monitoring the spatial distribution of charged particles or heavy ions extracted from an accelerator makes it possible to determine the beam profile, i.e., the transverse distribution of beam density. Beam particles interact with the sensors and eject secondary electrons from their surfaces. As a result, each sensor acts as a current source. The ratio of the total beam current to the total secondary electron current is referred to as the secondary electron emission coefficient. In this work, a multi-wire beam monitoring system for charged particles and heavy ions, developed at Saint Petersburg State University (SPbU) [2], was used as the experimental setup. An important feature of this system is the use of sensor electrodes made of different materials and alloys. This makes it possible to determine the secondary electron emission coefficients of various materials and alloys interacting with beams of both light charged particles and heavy ions over a wide energy range. Experimental data on secondary electron emission coefficients were obtained at the Unique Scientific Facility (USF) "A.F. Ioffe Institute of Physics and Technology U-120 Cyclotron" using 3 MeV proton beams and 53 MeV $^{40}\text{Ar}^{8+}$ ion beams. During the experiments, the profiles of both beams were visualized, and the parameters of the signals generated by the sensors upon interaction with the beam particles were investigated. Processing of the experimental data allowed, for the first time, the determination of the secondary electron emission coefficients of the sensor material (gold-coated tungsten) under irradiation by proton and argon-ion beams in the investigated energy range. These results provide a basis for validating theoretical descriptions of secondary electron emission processes induced by interactions of low- and intermediate-energy charged particles and heavy ions with matter.

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1. Bronshtein I. M., Fraiman B. S. Secondary Electron Emission. — Moscow: Nauka, 1969. 408 p.
2. Zherebchevsky V. I., Zemlin E. O., Maltsev N. A. Multisensor system for monitoring charged particle and heavy ion beams. RF Patent No. 2830097, Cl. G01T 1/34 (2024.08).

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