NEUTRAL PArticle analyzer based on syntetic diamond for the east tokamak

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Measurement of the energy spectra of charge-exchange atoms is important for studying the characteristics of plasma, the physics of thermonuclear combustion, studying the behavior of fast ions and forming the ITER mode of operation. This information is important for increasing the efficiency of heating and holding fast ions in the plasma. Synthetic diamond based detectors have the following properties: high sensitivity when detecting particles, radiation resistance, heat resistance and small dimensions. Such properties of the detector based on synthetic diamond material make it possible successfully apply it to register the spectra of charge-exchange atoms. [1, 2]. A synthetic diamond detector will be installed in the equatorial port D of the EAST tokamak. The atom analyzer consists of a diamond detector, a low-noise preamplifier installed outside the vacuum, a driver amplifier and an ADC. The detector connected to the preamplifier via a high-vacuum-through connector.

The diamond detector for the analyzer of charge exchange atoms was preliminarily calibrated at the FIAN ion accelerator with an operating energy range of 12–350 keV for singly charged ions, for alpha particles up to 700 keV. The detector recorded particles scattered on a silicon plate with a thin gold coating, to which an accelerator beam was directed. The detector in a coaxial case with an aperture of 2.6 mm in diameter was mounted on an anchor in the target chamber of the accelerator. The preamp was installed outside the camera on the feedthrough. The particle flux on the detector ranged from 91 to 2835 h/s.

The energy calibration of the detector was made during the registration of protons, deuterons, and alpha particles. The energy resolution of the detector was 16.7 keV for protons, 26.4 keV for alpha particles, and 16.1 keV for deuterons. The minimum registered energy of protons is 18 keV, deuteron 20 keV, alpha particles 22 keV.

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References

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