DEVELOPMENT of the charge exchange neutral particle analyzer for the mephist tokamak [[1]](#footnote-1)\*)

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In fusion devices, ion temperature is one of the most crucial factors characterizing plasma performance. Charge-exchange neutral particles’ energy spectrum analysis is a widespread technique for the determination of ion temperature. Such spectra might be obtained by ionization of neutral particles and subsequent spatial separation in electric/magnetic fields.

MEPhIST is a small educational research spheromak (*a* = 13 cm, *R*=25 cm) with a toroidal field up to 0,8 T, plasma current 8 kA and expected ion temperature 200 eV [1]. In such small machines for the energy spectra of charge exchange neutrals measurements a combination of a gas stripping cell and an energy analyzer with plane-parallel plates and a decelerating field can be used [2].

In this paper we present the design of a 7-channel charge exchange neutral particle analyzer for the MEPhIST tokamak and its calibration in the energy range of 0,5 – 5 keV. One of the unique features of this diagnostics is the use of the sulfur hexafluoride (SF6) as the stripping gas. It was shown (fig. 1), that for SF6 the maximum of the stripping efficiency lies in a lower pressure range compared to more commonly used stripping gases (H2, N2). In addition, it allows achieving a higher stripping efficiency of hydrogen atoms (up to 0,1). The dependence of the stripping coefficient by SF6 gas on the energy of incident hydrogen atoms is obtained. The energy resolution of the energy analyzer channels is also determined.



Figure 1. Stripping efficiency of various gases for 3 keV hydrogen atoms.

References

1. Kirneva N. A.., Vorobjev G. M., Ganin S. A. etc. Working area of the MEPhIST tokamak: preliminar estimation // Problems of atomic science and technology, ser. thermonuclear fusion, 2020, 43., № 3, p. 90–100.
2. Ajay K., Pandya S. P. & Aggarwal S. Experimental Results of Core Ion Temperature and Neutral Density Measurements on ADITYA Tokamak using Four Channels Neutral Particle Analyzer // Journal of Fusion Energy, 2020, 39, 3, p. 111–121.
1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/XLIX/Mu/ru/BM-Efimov.docx) [↑](#footnote-ref-1)