DETERMINATION OF PLASMA ISOTOPIC COMPOSITION FROM SPECTRUM OF ALFVÉN OSCILLATIONS [[1]](#footnote-1)\*)

DOI: 10.34854/ICPAF.2020.47.1.038

Abdullina G.I., Askinazi L.G., Belokurov A.A., Chernyshev F.V., Kornev V.A., Krikunov S.V., Lebedev S.V., Melnik A.D., Razumenko D.V., Smirnov A.I., Tukachinsky A.S., Zhubr N.A.

Ioffe Institute, St Petersburg, Russian Federation, [Abdullina@mail.ioffe.ru](mailto:Abdullina@mail.ioffe.ru)

In a future fusion reactor, careful monitoring of the concentration ratio of deuterium and tritium is required to ensure continuous maintaining of fusion these hydrogen isotopes, and as a result, the best thermonuclear yield. One of the methods for determining the isotopic composition of a plasma is based on an analysis of the spectra of Alfvén oscillations (AOs). The paper presents the results of experimental study of AOs in the TUMAN-3M tokamak plasma. On the JET tokamak, experiments were carried out [1], in which AOs were excited using an antenna and a generator, and the possibility of obtaining an isotopic composition profile was ensured by excitation of AOs with different mode numbers at different frequencies. Experiments with excitation of AOs for plasma diagnostics were also performed on the TCABR tokamak [2]. In this work, we studied AOs which develop in the plasma in a “natural" way in the ohmic regime [3–6].

The study of the effect of impurities on the spectra of AOs [7], performed on the TUMAN-3M, showed that the presence of an impurity with the mass-to-charge ratios A/Z is the same as that of the main ion (for example, an impurity of fully ionized carbon in deuterium plasma) does not affect the AO frequency. At the same time, the presence of an impurity with different A/Z (hydrogen addition in deuterium plasma, and vice versa) can be detected by a shift in the frequency of AOs. The information about radial localization of AOs r/a <0.5 [8] allows the evolution of the plasma isotopic composition to calculate using the evolution of the AO frequency in experiments with two isotopes: hydrogen and deuterium.

Two scenarios were used in the TUMAN-3M tokamak experiments: deuterium puffing into a hydrogen plasma and hydrogen puffing into a deuterium plasma. The isotopic ratios, i.e., relative concentrations of hydrogen  and deuterium  in the mixed hydrogen–deuterium plasma obtained by this method are in qualitative agreement with the results of spectroscopic measurements and neutral particle analysis data [9].

The study of Alfvén oscillations and measurements by charge-exchange particle flux diagnostics were supported by the Russian Science Foundation, project no. 16-12-10285-P. The experiments on the TUMAN-3M tokamak were supported by Ioffe Institute.

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