C1-P-046401

A COMPACT SETUP FOR LASER-INDUCED DESORPTION SPECTROSCOPY IN BACKGROUND RF PLASMA*

G.I. RYKUNOV[1,2], A.V. KAZIEV[1], A.I. ALIEVA[1], D.V. KOLODKO[1,3], M.M. KHARKOV[1], YU.M. GASPARYAN[1], N.S. SERGEEV[1]

[1]National Research Nuclear University MEPhI (Moscow Engineering Physics Institute), Moscow, Russia
[2]MIREA – Russian Technological University, Moscow, Russia
[3]Fryazino Branch of Kotel'nikov Institute of Radio Engineering and Electronics RAS, Fryazino, Russia

Development of remote control methods for diagnosing the content of hydrogen and its isotopes in the fusion-relevant materials is an important direction of plasma-surface interaction studies. There has recently been a renewed interest in laser techniques combined with optical spectroscopy for the local measurement and removal of hydrogen particles from materials, including laser-induced breakdown spectroscopy (LIBS), laser-induced ablation spectroscopy (LIAS) and laser-induced desorption spectroscopy (LIDS) [1]. Such methods can be realized and studied in a setup that meets the following requirements: 1) it should be a compact device; 2) it should incorporate laser source for surface diagnostics; 3) it should be suitable for implementation of spectroscopic measurements of species ejected from surface under laser exposure. The latter can be more effectively done in presence of a background diffuse plasma.

We have recently developed and built a wide-application compact device with radiofrequency (RF) inductively coupled plasma (ICP), and here we report equipping it with the millisecond-pulse laser and studying its characteristics. The high peak power that can be achieved on a sample surface with short laser pulse together with ICP plasma environment enable exciting the laser-desorbed material species for further spectroscopic analysis. It is important to use a laser with intensity less than that required for ablation, in order to analyze the material without damaging the surface. The scheme of the diagnostic setup is shown in Fig. 1.

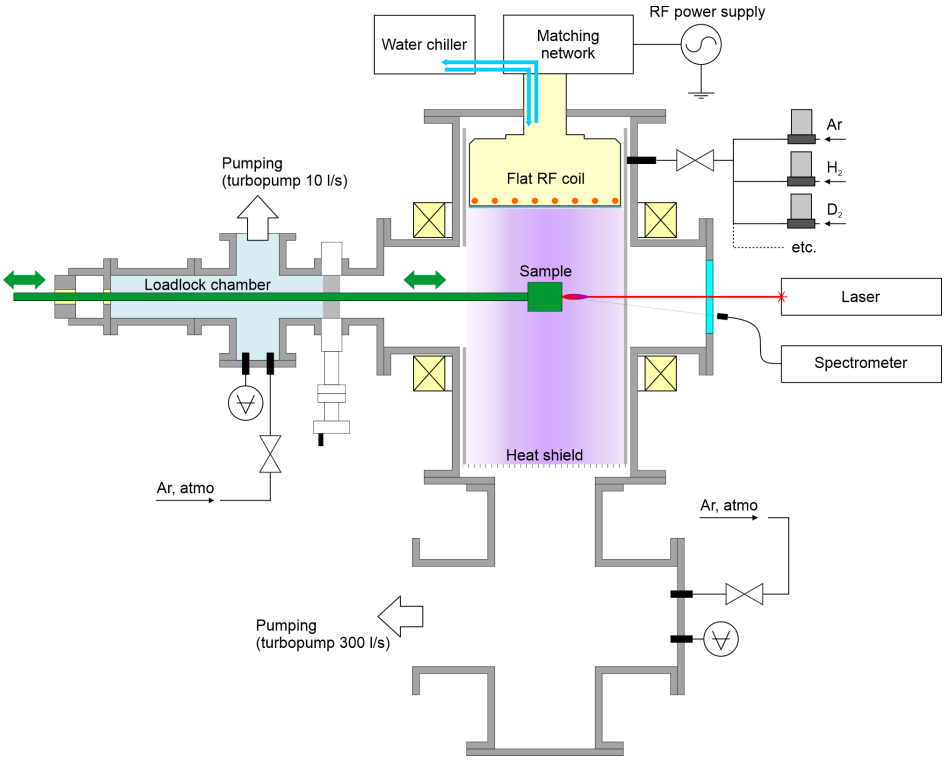

Fig.1. Diagnostic setup scheme.

REFERENCES

[1] J.H. Yu, M.J. Baldwin, M.J. Simmonds, A. Založnik, "Time-resolved laser-induced desorption spectroscopy (LIDS) for quantified in-situ hydrogen isotope retention measurement and removal from plasma facing materials," Rev. Sci. Instrum., Vol. 90, Article Number 073502, 2019.

* The work was supported by the Ministry of Science and Higher Education of the Russian Federation (project no. 0723-2020-0043).