HTSC GUIDE FOR NONCONTACT TRANSPORT OF CRYOGENIC TARGETS USING A MAGNETIC CARRIER [[1]](#footnote-1)\*)

DOI: 10.34854/ICPAF.2021.48.1.082

I.V. Aleksandrova, Е.R. Koresheva, E.L. Koshelev, A.I. Nikitenko, T.P. Timasheva

P.N. Lebedev Physical Institute of the Russian Academy of Sciences, Moscow, Russia, [koreshevaer@lebedev.ru](mailto:koreshevaer@lebedev.ru)

Development of a system for noncontact positioning and transport of the cryogenic fuel targets (CFT) is one of the most important problems in the general program of inertial confinement fusion (ICF). The experiments carried out at the Lebedev Physical Institute on the acceleration of a levitating CFT carrier made from Type-II, high-temperature superconductors (HTSC) along a magnetic rail have confirmed the fruitfulness of this approach [1−3]. In the report, we investigate the possibility of creating a reverse system − acceleration of a magnetic carrier along a superconducting tape guide made of HTSC materials.

In our studies, when constructing a noncontact accelerator of KTMs, it is proposed to abandon the traditionally accepted axial symmetry (see, for example, a cylindrical superconducting barrel in [4]) and go to an asymmetric version of a cryogenic injector with an HTSC tape as a guide rail.

The report presents the results of an experimental demonstration of the possibility of linear motion of the magnetic CTF carrier levitating over the HTSC guide rail under the influence of different control signals (magnetic, mechanical, gravitational).

The HTSC guide was either an open parallelepiped composed of 3 HTSC tapes, or a chute composed of 2 HTSC tapes located at an angle of 900 to each other. The HTSC tapes were manufactured by OOO SuperOx (Moscow) with the following parameters: length of each tape 55 mm, width and height − 12 mm, thickness − 65 μm. The dimensions of the tested magnetic carriers and their magnetic fields are as follows: cube (5x5x5 mm), 1160 Gs; ball (dia. 3 mm), from 30 to 46 Gs; disc (inner dia. 6 mm, outer dia. 15 mm, thickness 3 mm), 1500 Gs.

The experiments have shown that this approach is relatively simple, and therefore promising for solving the problem of not only injection CTF transport, but also simple positioning of CFT in the laser focus in the absence of any material suspension that is necessary to ensure the required symmetry of CFT irradiation by a laser.

This work was carried out within the framework of the LPI State Assignment and under the program of the Presidium of the Russian Academy of Sciences, as well as with the financial support of the International Atomic Energy Agency under contract No. 24154.

References

1. Aleksandrova I.V., Ivanenko O.M., Kalabukhov V.A., et al. HTSC maglev systems for IFE target transport applications. J. Russian Laser Research, 2014, 35 (2), 151−168
2. Aleksandrova I.V., Akunets A.A., Bezotosny P.I., et al. On the possibility of creating a system for the noncontact delivery of the cryogenic fuel targets to the IFE reactor. Bulletin of the Lebedev Physics Institute, 2016, №5, 15−25
3. Aleksandrova I.V., Koshelev Е.L., Nikitenko A.I., et al. Magnetic acceleration of the levitating sabot made of type-II superconductors. J. Russian Laser Research, 2018, 39 (2), 140−155
4. Wang X.W., Royston J.D. Superconductivity and Applications. eds. Kwok H.S., et al., Plenum Press, New York, 1990

1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/XLVIII/It/ru/DG-Koresheva.docx) [↑](#footnote-ref-1)