

RFNC-VNIIEF EXPERIENCE IN DEVELOPMENT AND OPERATION OF HYDROGEN ISOTOPES GAS-HANDLING SYSTEMS FOR BASIC RESEARCH

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A number of facilities and gas-handling systems were developed in the last decade under RFNC-VNIIEF conversion program to permit hydrogen isotopes (HI) investigations in different fields of physics. In 1995/96, a gas-supply system was developed to support muon catalyzed fusion studies /1/. Successful operation on the facility, TRITON, provided a muon source for the Dzhelepov Laboratory JINR (Dubna) branch and permitted regular research of the phenomenon (e.g. /2/). A conceptual design of an intense source of monochromatic 14 MeV neutrons of 10^{17} n/s has been developed /3/ in the same science field with participation of RFNC-VNIIEF specialists.

Subsequently, a series of gas system were developed for the cyclotron U400-M Flerov Laboratory JINR (Dubna) to generate a 58MeV tritium beam and HI targets (with their gas-supply systems). This combination permitted the study of neutron-excess in systems such as ^4H , ^5H , ^{10}He (e.g. /4/). VNIIEF-developed systems have been in successful operation at Flerov Laboratory since 2000.

RFNC-VNIIEF, JINR and ITEP jointly worked out conceptual design for an antineutrino tritium source with a 40MCi intensity to measure magnetic moment of antineutrinos at a level of 10^{-12} Bohr magneton and outlined the supporting experiment /5/. Unfortunately the lack of funding precluded experimental implementation.

The facility PROMETHEY has been developed in VNIIEF to study permeability and superpermeability of hydrogen isotopes, including tritium, through structural materials (SM) /6/. A set of investigations were performed using this facility under the ISTC project #1110 to study HI permeability through SM and to evaluate the effectiveness of various types of protective coatings to reduce HI permeability. The superpermeability of Nb to tritium has been demonstrated for the first time using this facility/7/. PROMETHEY and facilities intended for studies of SM behavior in high-pressure tritium also formed part of the ISTC project #2276 to investigate concurrent impact of hydrogen and radiogenic ^3He on the properties of stainless steel 12Cr18Ni10Ti an alloy that is similar to SS 321.

Approaches to the development of gas-supply systems, the technical aspects and the designs of these facilities' key elements are described in this paper. Results obtained on these facilities will be highlighted.

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