



Contribution ID: 482

Type: **Oral**

Status of DEMO-FNS development

Thursday, 20 October 2016 17:40 (20 minutes)

Fusion-fission hybrid facility based on superconducting tokamak DEMO-FNS is developed in Russia for integrated commissioning of steady-state and nuclear fusion technologies at the power level up to 40 MW for fusion and 400 MW for fission reactions. The project status corresponds to transition from conceptual design to engineering one. This facility is considered in RF as the main source of technological and nuclear science information, which should complement the ITER research results in the fields of burning plasma physics and control. The new knowledge obtained on the device may accelerate implementation of fusion technologies as well as construction of demonstration and commercial fusion power plants in RF. Fusion-fission hybrid technologies tested on DEMO-FNS are capable to improve the neutron balance in the global nuclear energy system. Implementation of hybrid and molten-salt technologies should also accelerate the development of Atomic energy reducing the radio-toxicity generated in nuclear fuel cycle and the level of pollution by fuel breeding and reprocessing. The development of fusion neutron source DEMO-FNS based on classical tokamak (CT) with a fusion power up to 40 MW was launched in the NRC "Kurchatov Institute" in 2013. The main goal of the 2015 activity was to determine the facility characteristics and to provide integration of the tokamak elements and hybrid blanket, operating in the subcritical regime with effective neutron multiplication factor $k_{eff} < 0.95$ and being designed for burning out minor actinides from spent fuel of contemporary thermal nuclear reactors. During the work on the blanket in 2015, a variety of coolants were addressed including - water, eutectic Na -K (liquid metal coolant with ~ -11 C melting point), as well as the helium gas coolant. The reasons for increasing the size of the tokamak and definition of geometric dimensions, structure and selection of hybrid blanket coolant with tritium breeding ratio greater than 1 will be presented in the report. Analyses of the interaction of DEMO-FNS facility with the nuclear fuel cycle of Russia's nuclear power industry is scheduled to be performed in 2016.

Paper Number

FNS/1-1

Country or International Organization

Russia

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Session Classification: Materials & Fusion Nuclear Science

Track Classification: FNS - Fusion Nuclear Physics and Technology