Contribution ID: **651** Type: **Poster**

Fusion Hybrid with Thorium Blanket: on its Innovative Potential at Fuel Cycle of Nuclear Reactors

Friday 17 October 2014 08:30 (4 hours)

Technology of controlled thermonuclear fusion (CTF) is traditionally regarded as a practically inexhaustible energy source. However, development, mastering, broad deployment of fast breeder reactors and closure of nuclear fuel cycle (NFC) can also extend fuel base of nuclear power industry (NPI) up to practically unlimited scales. Under these conditions, it seems reasonable to introduce into a circle of the CTF-related studies the works directed towards solving some principal problems which can appear in a large-scale NPI in closed NFC.
It was shown [1] that advanced nuclear fuel (231Pa-232U-233U) can be generated in thorium blanket of hybrid thermonuclear reactor (HTR). The first challenge is a large scale of operations in NFC back-end that should be reduced by achieving substantially higher fuel burn-up in power nuclear reactors. As was shown in [1], the use of 231Pa-232Th-232U-233U fuel in light-water reactor (LWR) opens a possibility of principle to reach very high (about 30% HM) or even ultra-high fuel burn-up.
The second challenge is a potential unauthorized proliferation of fissionable materials. As is known, a certain remarkable quantity of 232U being introduced into uranium fraction of nuclear fuel can produce a serious barrier against switching the fuel over to non-energy purposes.
Involvement of HTRs into NPI structure can substantially facilitate resolving these problems. If HTR will be involved into NPI structure, then main HTR mission consists not in energy generation but in production of nuclear fuel with a certain isotope composition.
The present paper analyzes some neutron-physical features in production of advanced nuclear fuels in thorium HTR blankets. The obtained results demonstrated that such a nuclear fuel may be characterized by very stable neutron-multiplying properties during full LWR operation cycle and by enhanced proliferation resistance too. The paper evaluates potential benefits from involvement of HTR with thorium blanket into the international closed NFC.

[1] E.G. Kulikov, G.G. Kulikov, E.F. Kryuchkov, A.N. Shmelev. "Achievement of higher LWR fuel burn-up by introducing 231Pa into fuel composition"–Nuclear Physics and Engineering, Vol. 4, No. 4, pp. 291-299 (2013).

Paper Number

FIP/P7-30

Country or International Organisation

Russian Federation

Author: Prof. SHMELEV, Anatoly (NRNU MEPhI)

Co-authors: Dr AZIZOV, Englen (National Research Center "Kurchatov Institute"); Dr KULIKOV, Evgeny (NRNU "MEPhI"); Dr SALAHUTDINOV, G (NRNU "MEPhI"); Dr KULIKOV, Gennady (NRNU MEPhI); Prof.

KURNAEV, Valery (NRNU "MEPhI"); Dr APSE, Vladimir (NRNU "MEPhI")

Presenter: Dr KULIKOV, Gennady (NRNU MEPhI)

Session Classification: Poster 7