



Slow Nuclear Burning Phenomenon & Traveling Wave Reactor

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Vendredi 08 avril 2022

Salle de réunion Bâtiment 108

The physical concept of a safe breeder reactor operating in a self-sustaining nuclear burning wave mode was proposed by Lev Feoktistov [1] in 1988, and was further developed in the work of Edward Teller [2], Hiroshi Sekimoto [3] and others. In 2006, with the financial support of Bill Gates, a private company, TerraPower [4], was created to put this concept into practice.

The special attractiveness of such a reactor concept is associated with the absence of the need for on-line control of reactivity, as well as the absence of a reactivity margin in it. The critical state in such a reactor is maintained automatically, which is due to a special mechanism of negative reactivity feedback and ensures its so-called "intrinsic safety". A reactor campaign can last for decades without refueling and reprocessing of fuel, which can be natural or even depleted uranium and thorium, as well as spent fuel from other reactors. The possibility of afterburning long-lived radionuclides (MA) in it is assumed.

The proposed report briefly discusses the physical essence of the phenomenon of slow nuclear combustion in the form of a traveling wave, as well as the problems that stand in the way of its practical implementation. The results of studies of this problem obtained in recent years at the NSC KIPT (Kharkov, Ukraine) [5,6] are presented.

1. L.P. Feoktistov. Preprint IAE-4605-4, 1988; *Sov. Phys. Doklady*, 34 (1989) 1071.
2. E. Teller. *Nuclear Energy for the Third Millennium*. Preprint UCRL-JC-129547, LLNL, 1997.
3. H. Sekimoto, *Light a CANDLE. An Innovative Burnup Strategy of Nuclear Reactors*, TIT, Tokyo, 2010.
4. Bill Gates, *TED*, February 12, 2010. http://www.ted.com/talks/bill_gates.html
5. S. Fomin et al. *Annals of Nuclear Energy*, 32 (2005) 1435; 148 (2020) 107699.
6. S. Fomin et al. *Progress in Nuclear Energy*, 50 (2008) 163; 53 (2011) 800.