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### Fast reactor with liquid U-Pu fuel: Its applications and fuel cycle

Fast reactor is the necessary element of the future nuclear power. But the contemporary fast reactors are not inherently safe (in Weinberg's definition) and have the serious problems with the fuel nuclear cycle closing, the low fuel element burning and their repeated fabrication from the hot spent fuel. Molten salt reactors (MSR) are free from these shortages. Their void and temperature coefficients are negative; they do not need in the fuel elements fabrication and give the opportunity to organize online hot spent fuel reprocessing. First MSR was in operation during almost 5 years with Th-U fuel and thermal neutron spectrum, which is adequate for this fuel (MSRE, Oak Ridge, 1964-1969). However its neutron balance is poor in comparison with U-Pu fuel and fast neutron spectrum. This is impossible to combine all three ideas (fast spectrum, molten salt and U-Pu fuel) yet because the PuF<sub>3</sub> solubility in the fluoride salts is too less. Five years ago it was established experimentally that PuF<sub>3</sub>, UF<sub>4</sub> and AmF<sub>3</sub> solubility in the eutectic 46.5 mol% LiF-11.5 mol% NaF-42.0 mol% KF (FLiNaK) are equal to 33, 45 and 43 mol% respectively at 700°C. This observation opens the way for the development of the fast molten salt reactor with U-Pu fuel cycle (U-Pu FMSR) as well as the effective FMSR reactor-burner of Am. U-Pu FMSR based on FLiNaK can work in the equilibrium mode at the concentration UF<sub>4</sub> and PuF<sub>3</sub> 22 and 7 mole% respectively using as a fuel <sup>238</sup>U only. FMSR reactor-burner can transmute ~300 kg Am/year-MWth without Pu feeding, i.e., one GWth FMSR-burner can disintegrate Am from the spent fuel of ~40 standard 1 GWe thermal reactors after 5 years of cooling.

### Biography

Leonid Ponomarev graduated from Physics Division of Moscow State University in 1963. He has completed his PhD in 1966 and Doctors degree in Nuclear Physics in the year 1971 at Joint Institute for Nuclear Research, Dubna, Russia. At present, he is the Principal Expert of AA Bochvar Institute in Moscow, Professor and Member of Russian Academy of Sciences. He is an Expert in Atomic and Nuclear Physics, Muon Catalyzed Fusion. He is the Scientific Leader of the Research Program of the Fast Molten Salt Reactor Development. He is the author of 200 papers and 4 monographs.

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