ASSESSMENT OF CAPABILITY FOR PLASMACHEMICAL SINTHESYS OF OXIDE AND CARBON-OXIDE COMPOSITIONS FOR DISPERSION NUCLEAR FUEL

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Modern atomic energetics using oxide nuclear fuel (NF) in form of uranium dioxide (enriched in uranium-235) in thermal neutron reactors has many advantages as well as disadvantages. Major disadvantages are low thermal conductivity; frailty of ceramic fuel and possibility to fracture at high temperatures; short usage cycle; impossibility to create low capacity power generation systems; high costs on spent NF utilization; uranium-235 finite life. These all slow down atomic energetic development.

One of the upcoming trends in atomic energetics development is creating reactor systems which use dispersion NF. In that fuel granular oxide nuclear compositions are placed in matrix. Dispersion NF characterized by lack of direct contact between granules due to their regular distribution in matrix and has the following advantages: high thermal conductivity and mechanical properties; low formation of gaseous fission products; high fuel burnout and nuclear hardness; high durability; localization of fission products in granules; low heat reserve in fuel etc. However, dispersion NF has some substantial disadvantages that are parasitic neutron capture by matrix material; necessity to apply high enriched materials, which raises risk of fuel critical mass excess. Besides, technological scheme that is used to obtain granulated oxide compositions for dispersion NF from mixed nitric solutions (MNS) based on sol-gel process that has many longtime and laborious stages [1].

Application of low temperature plasma is promising to MNS treatment. Major advantages of plasma technology are next: one-stage process; high processing speed; homogenous stoichiometrically-defined phase distribution; possibility to have an impact on particle size and particle morphology; compactness of technological equipment etc.

Article represents results in simulation of plasma treatment of MNS in form of water-salt-organic compositions (WSOC). Authors defined formulations of WSOC and operational modes providing direct plasmachemical synthesis of oxide and carbon-oxide compositions.

REFERENCES

1. Toumanov I.N., Sigailo A. V. Plasma Synthesis of Disperse Oxide Materials from Disintegrated Solutions // Materials Science and Engineering. 1991.– Vol. A140.– P. 539-548.