SIMULATION OF KINETIC PROCESSES, OPTICAL AND NEUTRON PROPERTIES OF THE NUCLEAR-EXCITED DUSTY PLASMA OF NOBLE GASES

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S u m m a r y

A model of kinetic processes in the argon-xenon gas plasma with the admixture of uranium nanoclusters is developed. This dusty plasma seems to be perspective as an active laser medium in the technologies of direct conversion of the nuclear energy into coherent light. The process of formation of quasistationary states in plasma and the influence of uranium nanoclusters are considered in the developed mathematical model of the kinetic processes in the argon-xenon gas excited by nuclear fission fragments. The suggested system of equations allows one to describe the kinetic processes in the plasma with presence of the uranium dust in a self-consistent way. The model include the evolutionary equations for the distribution function of electron velocities and for concentrations of a different components of plasma, including charged uranium nanoclusters. The model takes 44 components of plasma and 507 plasma-chemical processes into account. The method of solution of such equations is suggested, and the program complex realizing this method is developed. The influence of the dust concentration on the optical and neutronic properties of the plasma media is studied in calculations. The calculation of the neutron multiplication factor for the laser active infinite medium containing uranium dust particles is performed with the use of MCNP-5 code. The neutron cross-sections needed for calculations were taken from the ENDF/b-VI library. The attenuation of electromagnetic waves by uranium dust particles was calculated in the frame of the Mie theory for various spherical particle sizes and different wavelengths. Real and imaginary parts of the refraction coefficient for uranium needed for this calculation were taken from the experimental and theoretical works.