Electron energy distribution in helium plasma generated by fission fragments

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The problem of ionization and excitation pair prices in any gas medium can be solved by modeling the process of exchanging energy of the primary electrons with neutrals by Monte Carlo technique.

The calculation code was compiled on the time depending processing circuit branching process for generations. After each act of ionization electron traced with more energy, and the energy of secondary electrons born are also randomly played and memorized in all of an electronic memory. Tracking the trajectories of the primary electron energy was carried out up to 0.1 eV. The time dependence of electron energy distribution in nuclear excited helium plasma is found and analyzed in the present paper.[1]

Taking into the consideration that fast protons and tritons colliding with neutrals interact through a Coulomb field we use results obtained by Michal Gryzinski [3].The products of the reaction

 $+n\rightarrow +p+0.76Mev$ (1)

will meet helium neutrals but interact with orbital electrons exciting and ionizing helium atoms. The ionization rate is defined by the density of thermal neutrons and by the energetic electron and ion pair formation price Ω and equals:

 $S=\frac{n\left(\right)\*Ф\*σ\_{f}\*E\_{0}}{Ω}$, (2)

where n(3He) is the concentration of helium atoms, Ф is the neutron flux, $σ\_{f}$ is the cross-section of nuclear reaction (3.1), E0 is the kinetic energy of fission fragments.

Excitation cross sections of helium atoms by fission fragments are evaluated by the following[2]:

 $\sum\_{p,T}^{}\left(E\right)=f\_{v}\*\frac{σ\_{0}}{(E-I\_{excitation})^{3}}\left[\frac{V\_{p,T}^{2}}{V\_{p,T}^{2}+V\_{e}^{2}}\frac{(I\_{He})}{\frac{m\_{e}V\_{e}^{2}}{2}}+\frac{2}{3}\left[1-\frac{I\_{excitation}}{∆E\_{max}}\right]Ln(2.7+\frac{V\_{p}}{V\_{e}})\right]\left[1-(\frac{I\_{excitation}}{∆E\_{max}})\right]^{1+\frac{V\_{p}}{V\_{e}}}$, (3)

where $I\_{excitation}$ is the excitation energy.

References

1. Kunakov S.K., Son E.E., Probe Diagnostics of Nuclear Excited Plasma of Uranium Hexafluoride // High Temperature. 2010. Vol.48. N. 6. P.789–805.
2. Michal G., Classical Theory of Atomic Collissions. // I.Theory of Inelastic Collisions, Physical Review. 1965. Vol. 138. N. 2A.