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Absolute emission cross section of dissociative products in $He^+ - N_2, O_2$ collisions

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Absolute emission cross section of excited products was determined in vacuum ultraviolet $50-130nm$ end visible $400-800nm$ spectral region. The measurements were carried out by optical spectroscopy method in the $1-12keV$ energy range of He^+ions. An estimation of uncertainties of the absolute value of all cross sections given here did not exceed $20-25\%$ and the accuracy of relative measurements was $4-5\%$.
Emission cross-section and linear polarization of the excitation of helium atomic $HeI(388.9nm)$ and nitrogen ionic $NII(500.1-500.5nm)$ lines have been measured. High degree of the polarization $P=-20\%$ was observed in the case of helium line. Such a great negative value of the degree of polarization indicates that $m_l = \pm 1$ sublevels of the excited state $3p(^3P)$of helium atom are preferably populated. Analysis of the experimental results indicates that the electron density formed in He^* during the collision is oriented perpendicularly with respect to the incident beam direction. Strong correlation is revealed between inelastic channels of the formation of excited helium and nitrogen particles. To discuss the results of the formation of inner shell vacancy the quasidiatomic approach has been used. In terms of this approximation the excitation of inelastic channels is induced by transitions of electrons at crossings between an initially occupied and promoted molecular orbital (MO) with empty MO's.In our case initial vacancy in $He(1s)$ orbital becomes an inner vacancy of the quasimolecule, hence core-excited, one-hole molecular states can be formed.In particular, in the case of He^+-O_2 the decay of one-hole$2\sigma_g^{-1}$ high excited molecular states$^2\Sigma_g^-$or $^4\Sigma_g^-$ of oxygen cause the excitation of intense oxygen ionic line $OII(83.4nm)$,while in the case of $He^+ - N_2$ intense line $NI(120.0)$ are excited as result of decay of one-hole 2sσ_g^{-1} intermediate molecular state of N_2^+. The energy dependence of the excitation cross section of the most intense atomic $NI(120,0nm))$(3s^4P- $2p^3\ ^4P$)) and ionic $NII(108.4nm$, $2p^3\ ^3D$- $2p^{23}P)$ lines exhibit a similar shape with maxima below $1keV$. Moreover, the absolute values of the excitation cross sections for these lines are close to each other. Probable it means, that the excitation mechanisms of the molecular states which dissociate into $N^*(3s\ ^4P)$ and $N^{+*}(2p^3\ ^3D)$ products are the same.