APPROXIMATION OF THE ION DRIFT VELOCITY IN PARENT GAS

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In work we carried out calculations characteristics drift of ions in the gas, helium, neon, argon, krypton, xenon, and cesium, rubidium and mercury at gas temperatures 4.2, 77, 300, 1000, 2000 K, and a wide range of reduced electric field strength - from 1 to 10000 Td [1 - 3]. For the calculation ion-atom collisions model was used, it was implemented by the Monte Carlo method [1]. Numerous experimental data show that the drift velocity of the ions in their own gas is very well described by the semi-empirical formula Frost [2, 3]:

. (1)

This dependence of the drift velocity of the reduced electric field has two parameters: *a* - the mobility in the weak field limit and  . The value - this is the value of the reduced electric field strength, which due to the heating of the ions according to the formula Frost mobility decreases in the root of two times. Parameters of the approximation in the formula (1) were identified based on the analysis of the calculations of the kinetic characteristics for different gas temperatures:

. (2)

Here  - adjustable parameter,  and  - temperature and density of the atoms,  - polarization mobility in units cm2 / (V s) at a standard density of the gas  atoms in см3 (number Loschmidt),  - polarizability in cubic Angstroms,  - reduced mass in grams per mole [5].

. (3)

|  |  |  |  |
| --- | --- | --- | --- |
| *System* | *Kpol*  см2/с В | *,*  *K* | *(E/N)0,*  *Td* |
| He+ in He | 21.6 | 90 | 16 |
| Ne+ in Ne | 6.8 | 210 | 34 |
| Ar+ in Ar | 2.42 | 240 | 73 |
| Kr+ in Kr | 1.36 | 330 | 106 |
| Xe+ in Xe | 0.85 | 270 | 122 |
| Hg+ in Hg | 0.61 | 58 | 63 |

In the Table for different gases are given the values of polarization mobility , parameters and  - a value of a warming field at zero temperature gas. As the analysis of calculated data, parameter  is not independent, and can be determined by the formula . This formula is derived from the relation  , which is performed with an accuracy of about 1%, here .

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References

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