Ion accumulation by spherical clouds of microparticles

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The parameters of the plasma of a low-pressure electric discharge in neon with spherical clouds of charged microparticles [1,2] have been calculated. The behavior of ion accumulation efficiency [3] indices by microparticles as a function of gas concentration and microparticle concentration was studied. For the efficiency index reflecting the ability of the cloud to accumulate ions per microparticle [4], the value of the limiting concentration of microparticles in a dense Coulomb sphere is obtained, exceeding which leads to a decrease in the considered value. The pressure and temperature of the experimental medium corresponding to the formation of spherical clouds were compared to the parameters of the standard atmosphere at different altitudes. It is shown that microparticles of larger size, located at the same height with smaller ones, have a higher ions accumulating ability. It is found that for all particles of the considered size the efficiency of ion accumulation by a microparticle increases with increasing height. It is found that smaller microparticles with decreasing height lose the ability to accumulate ions effectively faster. Comparison of calculation results for air and neon plasmas showed that at the same atmospheric height the accumulating ability of microparticles in air plasma will be only not much lower than in neon plasma.

[1] Polyakov D N, Shumova V V and Vasilyak L M 2019 *Plasma Sources Sci. Technol.* **28** 065017

[2] Polyakov D N, Shumova V V and Vasilyak L M 2023 *Russ. J. Phys. Chem. B.* **17** 1241–1245

[3] Polyakov D N, Shumova V V and Vasilyak L M 2022 *Plasma Sources Sci. Technol.* **31** 074001

[4] Shumova V V, Polyakov D N and Vasilyak L M 2025 *Adv. Chem. Phys.* **44** 106–114