Substantiation of Breakdown Voltage Calculation for High-Voltage Accelerators, Insulated by Binary Mixtures N_2 - Co_2

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Abstract

The main grounds of a rather accurate calculation of accelerator gas gaps breakdown voltage for variable electrode geometry are given. On the 2nd stage of the calculation technique development a variable composition of binary mixture N_2 / CO_2 is considered.

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1. Introduction
2. The insulation system element model
3. The method of the base
4. The breakdown voltage calculation at a variable composition of the electronegative gas. Nitrogen – normalizing gas
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Table. The calculation error estimation for the N_2 / CO_2 mixture

Structure of h-v. accelerators	Terminal EG-3[3]	Column EG-3 [3]	Tandem MP [25]	Tandem MP [25]	Column EG-2,5[3]
χ_{CO_2}, %	20	20	20	50	20
S_{eff}, m^2	1.0	0.08	1.42	1.42	0.16
E_{max}/U_{calc}, 1/m	4.64	5.52	2.422	2.385	2.307
R_{av}, ì	0.35	0.0476	0.0373	0.0373	0.0251
L, ì	0.45	0.45	1.8	1.8	0.45
k_{non}	2.088	2.484	3.83	3.83	2.75
$(\sigma / \overline{U})_{calc}$, %	3.9	3.9	3.9	3.90	3.9
U_{calc}, MV	3.50	base	2.417	2.393	2.574
δU_{calc}, %	–0.3	–	–1.7	–10.4	–1.6

It can be seen that the error of the method of the base equals 0.3÷1.7 % for the atmospheric air and about 0.3÷1.6% for N_2 / CO_2 mixtures. The high accuracy of the method of the base is explained by the fact that conception "inherent electrical strength – asymptotic breakdown field intensity E_{asm} for the gas-electrodes combination" was taken as the foundation of the calculation. The element model accepted for the insulation system is adequate for the nature of the gas discharge.