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DEPENDENCES BETWEEN PARAMETERS OF VARIOUS MODELS OF ELECTRON BEAMS

Computer simulation of irradiation processes allows correctly to schedule and control the performance of work on radiation processing installations [1]. However, for performing calculations it is required the knowledge of some characteristic values of the process irradiation. In particularly for electron beam (EB) processing it is required the knowledge of EB energy characteristics. The paper [2] describes the method of the fitting of the two-parameter semi-empirical model to the results of measuring the depth-dose curve of electron radiation performed with dosimetric wedge. It is proposed to use as baseline data the parameters E_0 and X_0 , which were obtained by the fitting of two-parameter semi-empirical model. Parameters E_0 and X_0 describes of EB for the simulation of irradiation process on the radiation-processing facility.

Presented results of approbation method on data from series of measurements, of indicate the prospects of using the method for determining the energy characteristics of EB in the practice of radiation-technology centers.

The paper present the dependences between the standard characteristics of the EB energy (E_p, E_{av}) [3] and parameters (E_0, X_0), which has been proposed in two-parameter model [2] for the simulation of EB irradiation process on the radiation-technological lines.

Standard characteristics (R_p, R_{50}) for the absorbed depth-dose distribution of EB that were obtained by processing the measurement results [3], which uniquely determined the values of characteristics of the beam energy (E_p, E_{av}), were used for obtaining relations.

Of the physical interpretation of the parameters (E_0, X_0) model of the electron beam [2], the following equations are true:

$$R^*_p(E_0) = R_p + X_0 \quad (1)$$
$$R^*_{50}(E_0) = R_{50} + X_0 \quad (2)$$

where $R^*_p(E_0)$ and $R^*_{50}(E)$ - a practical range of electrons and the depth of the half dose reduction in the aluminum target as function of the electrons
energy E, which were determined in the semi-empirical model of the depth-dose distribution of electrons.

Calculations of the depth-dose distributions in aluminum for various electron energies, on base of the semi-empirical model, were performed. The results of calculations for characteristics R_p and R_{50} are shown in the table. Approximation of the table data with use of a linear functions for $R^*_p(E)$ and $R_{50}^*(E)$ allows to obtain the following expressions:

$$R^*_p(E) = 0.2092*E - 0.0687,\ R^*_{50}(E_0) = 0.1691*E - 0.0965. \quad (3)$$

Table

E, MeV	R_p, см.	R_{50}, см.
2	0.3558	0.2576
4	0.7667	0.574
6	1.1798	0.91
8	1.6036	1.246
9	1.8116	1.4224
10	2.028	1.5904
11	2.2331	1.7612
12	2.4447	1.9516

The dependence between parameters of the standard model - (R_p, R_{50}) with the parameters of the two- parametric model of the electron beam - (E_0, X_0) can be determined by considering the relations (1) and (2) as a system of two equations with two unknowns. In this case, an obtained linear approximations for the dependences of $R^*_p(E)$ and $R^*_{50}(E)$ allow to convert the resolution of assigned task to standard solution of system with two linear equations. Correctness use of linear approximations for the dependencies $R^*_p(E)$ and $R^*_{50}(E_0)$ are discussed in the report.

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