TRANSLATION

ABOUT RADIATION INJURIES TO RADIO COMPONENTS IN A SHARP GAMMA-RADIATION FIELD

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A study of the effect of nuclear radiations on various radio components shows, that with the exception of certain types electric parameters of resistances and capacitors remain practically unchanged after gamma-radiation. The observed changes in parameters of details depend upon the nature of radiation (spectrum, intensity, and integral dosage), as well as upon the technology of preparing radio components (1, 2).

None the less, a more thorough study of the behavior of these details, especially various types of capacitors, in a strong field of gamma-radiation and after obtaining by it greater integral dosages it presents,

in our opinion, a definite practical interest. We are especially interested in the relation between the change in electric parameters of capacitors in radiation injury of materials, from which they are made.

We investigated the effect of powerful dosages of gamma-radiation on electric and mechanical properties of certain industrial capacitors with different dielectrics. The investigation covered mica, paper oil, electrolytic and ceramic capacitors. In order to eliminate the effect of conventional errors on the results, we tested several capacitors of each type and average the obtained data.

The capacitance of the capacitors, leakage resistance, quality were measured prior and after radiation on instruments fo UM-3 and Pimel type. The charge of the capacitors was determined at working voltage on them.

Nonirradiated capacitors were placed in a cobalt radiator with a dosage capacity of 650 physical reoentgen equivalent/sec and the subsequent measurements were carried out after radiation with dosages of 100.10^6; 200.10^6 fer (physical roentgen equivalent) and so on, all the way up to 1100.10^6 fer. Some samples were subjected to continuous radiation until they obtained an integral dosage of 1100.10^6 fer.

Below are given results of measuring the capacitance of capacitors of KDK-2 type in dependence upon the radiation dosage:

Prior to radiation, micromicrofarad

	$100 \cdot 10^6$	$200 \cdot 10^6$	$800 \cdot 10^6$
12,56	12,56	12,44	12,23
12,80	12,50	12,55	12,78
12,48	12,48	12,40	12,30.

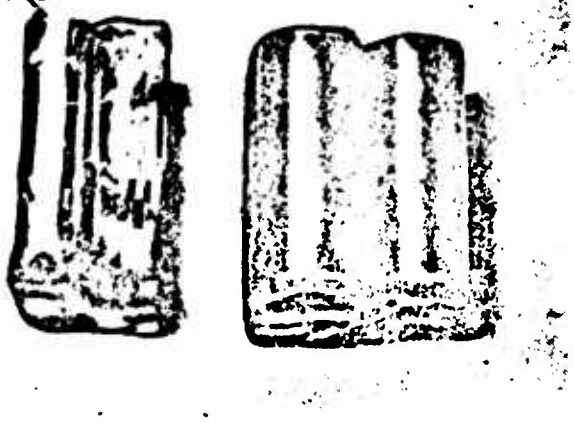

Fig. 1

After radiation, fer

Fig. 2

The values of capacitor capacitances of various types prior and after obtaining by them of integral dosage of 1100.10^6 fer at continuous radiation has the following values:

Type of capacitor	prior to radiation	Capacitance after radiation
BM	0.0121 microfar	0.0144 mfar.
KBGM	0.0247 microfar	0.0253 mfar.
PM	4635 mfar	4622 mfar.
KSO	1217 mfar.	1217 mfar.

Systematic changes in capacity, quality, capacitor resistance, going beyond the limits of errors, we have not observed. At the same time the capacitors, particularly paper ones, obtained considerable radiation damage, caused, apparently, by radiolysis of oil and

structural changes of the dielectric. Noticed were swellings of metal bodies of the capacitors of BM, KBGM type, of electrolytic capacitors, and also flow out of oil and condensation mastics.

In Fig. 1 and 2 are given photos of opened nonradiated and radiated to a dosage of 1100.10^{6} for capacitors. During the opening the paper insulator of irradiated capacitors was slightly disrupted to inconsiderable mechanical forces. This very same phenomenon was also observed in an effort to carry out the unwinding of a paper oil irradiated capacitor.

In spite of the considerable radiation damages electric parameters of capacitors as result of radiation remained practically unchanged. Unexplained, however, is the question by how much the service life of the irradiated capacitors has decreased. It is apparent, that in over straining conditions, at brief pulses or overloads radiation of capacitors with greater radiation damages will rapidly come out from commission. It is important to mention, that even at such enormous integral dosages, which we have used, the capacitors remained perfectly workable at least for a short time.

Literature

1. Effect of radiation on materials and components. Collec. of reports, ed. 27, Izdat. Glavnogo Upravleniya po Ispol'zovaniyu Atomnoy Energii pri Sovete Ministrov SSSR, Moscow, 1959.

2. Glaznev Sh, M., Aripow, G.O. About results of radiation of radiotechnical components with gamma-rays. In coll. Certain problems of applied physics Acad. of Sc. Uzbekh SSR, 1961.