FAST SWITCHING IN CADMIUM TELLURIDE THIN FILMS

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To ensure protection of circuits, use protective elements for radio electronic equipment (REA) against surge overvoltages. The important characteristic of protective components: dischargers, semiconductor discharge diodes, varistors and current-limiting diodes is their ability to resistance reduce from 10^4 - 10^{10} ohms in a short time τ_{sw}(tripping time) to a value lower than the input value of the REA element, when their voltage exceeds the threshold voltage U_t, called switching or activation threshold. If elements are parallel connected with the protected device, and when U_i more than U_t, the voltage amplitude across the device is reduced to U_t (voltage regulator, varistor, current limiting diode) or significantly less than U_t. Clipping silicon diodes have become the most common diodes because of their high speed (τ_s on the order of 1 nanoseccond). Such device can shunt a finite amount of energy and have 20 pF capacitance of interelectrode, which prevents their use for protecting microwave REAs.

To design a protection element for microwave REAs, in our work, the amplitude versus time characteristics of switching processes in thin films of cadmium telluride are investigated. The amplitude-time characteristics of the switching in the obtained CdTe thin films were studied according to the experimental oscillograms. Before characterizing the switching process, determine the trigger threshold, which is performed by applying a rectangular pulse to the sample. This first pulse has the minimum amplitude required. Then, apply several measurement pulses with the minimum amplitude required for continuous activation, identified with voltage U_t. The table shows the trigger threshold voltage U_t, maximum voltage U_s on the sample, the maximum permanent sample voltage U_{max}, the minimum permanent sample voltage U_{min}, and time of switching τ_s to the state with low resistance. The resistance value of the sample to DC R_e after 20 times the pulse exposure, with amplitude U_i. The magnitude of the determined amplitude versus time parameters does not depend from polarity of current pulse applied to the film sample.

Experiments confirmed that cadmium telluride layers with thickness from 3 to 7 micrometers can be usage for manufacture protect elements for UHF radio-electronic equipment, since samples representing thin-film cadmium telluride layers were inserted in the housings of standart diodes, and when applicate to them electrical pulse for a duration of 1 microsecond, the switching time is 2 ns, and the capacity does not exceed 2 pF. At the same time, the residual voltage value can be cut to 5 V, and the activation voltage value can be changed by the thickness of the layer of thin-film material.

References:

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