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THYRISTOR BASED SWITCHES TRIGGERED IN IMPACT-IONIZATION WAVE MODE

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The process of triggering thyristors by an overvoltage pulse with a short rise time was implemented. Low-frequency commercial thyristors of tablet design with diameters of silicon wafers of 32 to 56 mm and an operating voltage of 2 to 2.4 kV DC were used in the experiments. An external overvoltage pulse was applied across the thyristor main electrodes, which ensured a voltage rise rate from 0.5 to 6 kV/ns within a few nanoseconds. Under such conditions the thyristor closing process occurred due to initiation and propagation of a fast ionization front across the semicon-ductor structure. The time of switching the thyristor from the blocking state to the conducting state was within 200 to 400 ps. The thyristor based switches contained 2 to 9 series connected thyristors and operated in this triggering mode in different discharge circuits. Operating voltage was 5 to 20 kV and capacitance of discharge capacitors was 2 to 800 μF. The experimental results obtained covered the following range of discharge parameters: discharged current amplitude of 10 to 150 kA, current-rise rate of 15 to 130 kA/μs, current rise time (0.1-0.9 level) of 0.4 to 5 μs, pulse duration (FWHM) of 1 to 20 μs, and switching efficiency of 0.85 to 0.96.
The paper will discuss the experimental circuitry, tested switches design, and results obtained. The results of numeri-cal simulations of the thyristor switching process will also be given.

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