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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 semiconductor 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 numerical simulations of the thyristor switching process will also be given.

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