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PHOTOELECTRICAL CHARACTERISTICS OF TiO_2-n-Si HETEROSTRUCTURES

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The influence of thermal annealing on photoelectrical properties of TiO_2-n-Si structures is studied. Titanium oxide film with thickness of 70 nm were prepared by magnetron sputtering on Si epitaxial layer with the donor concentration of $N_d = 7 \cdot 10^{14}$ cm^{-3}. Before deposition of dielectric film the Si wafer was exposed to chemical cleaning. Then, the Si-substrate with dielectric film was separated into several parts. One part was not subjected to annealing, and the two parts were annealed in Ar atmosphere for 30 min at temperatures T_a = 500° and 750ºC. In the study of the photoelectric characteristics the structures were irradiated by LED at λ = 400 nm from the titanium oxide film side. Unlike photodiodes with Schottky barrier and metal-SiO_2-n-Si structures the currents at positive potentials on the gate increase during exposure to radiation, starting with the low voltages. The currents at negative potentials at the gate show significantly greater sensitivity to light. In structures without annealing and after annealing at 500°C, there is a threshold voltage of reverse-current growth at the light exposure. The value of voltage depends on annealing temperature. A characteristic feature of reverse currents after switching off the light is the appearance of residual currents. However, after one month the dark currents of the samples annealed at 500°C become 2 times lower in comparison to the dark current baseline values. This effect can be used for practical purposes as a method for leakage current reduction in MIS structures with dielectric TiO_2 films. The curve for the dark current immediately after switching off the light is significantly higher than the initial one. This phenomenon is known as a frozen photoconductivity (persistent photoconductivity).