INFLUENCE OF GAMMA IRRADIATION ON ELECTRIC AND DIELECTRIC PROPERTIES OF $TlGaTe_2$ CRYSTALS

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$TlGaTe_2$ has a quasi-one-dimensional layered structures and exhibit para-to-ferroelectric phase transitions through an intermediate incommensurate phase. $TlGaTe_2$ exhibit nonlinear transport properties. This structure is body-centered tetragonal and features c-axis chains of atoms and edge-sharing $GaTe_4$ tetrahedra.

The $TlGaTe_2$ monocrystals were grown by the modified Bridgman-Stockbarger method. The measurements were carried out on the sides perpendicular to polar axis. The sides were ground and covered by silver paste. Dielectric constant $\varepsilon(T)$ and angle tangent of dielectric losses were measured by the alternating current bridge E7-8 (1 кHz), P5058 (10 кHz), E7-12 (1 мHz) and Tesla BM560 (100 кHz) in the temperature region 150-250K. The velocity of temperature scanning was 0,1 K / min. The loops of dielectric hysteresis were studied at frequency 50 Hz using the modified circuit Soyer-Tower. The pyroeffect has been investigated by the quasistatic method using universal voltmeter V7-30.

The samples were irradiated (Co^{60}) at room temperature. The irradiation dose was accumulated through sequential exposures of the same sample and reached 100, 200, 300 and 400 Mrad. The dependences $\varepsilon(T)$ and $\sigma(T)$ were measured after each exposure of the sample to irradiation. Conductivity was measured by the alternating current method. The temperature dependencies of dielectric constant $\varepsilon(T)$ of $TlGaTe_2$ crystals at different frequencies are measured.

It is known, that the presence of an impurity in the semiconductor results in occurrence of local states near the Fermi level. On these local states the hopping mechanism of charge transport is realized, which essentially influences both on electrical, and dielectrically properties of semiconductor-ferroelectrics. $TlGaTe_2$.

According to the temperature dependencies of dielectric constant $\varepsilon(T)$ study, $TlGaTe_2$ has temperature instabilities of the crystal lattice lead to ferroelectric ordering.

INFLUENCE OF RARE EARTH ELEMENTS ON RADIATION DEFECT FORMATION IN SILICON

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It is known that efficiency of form and kinetics annealing of radiation defects influence greatly presence of initial in controlling electrically active or inactive impurities, their concentration and position in a lattice of a semiconductor. From this point of view of impurities of group of rare earths

elements (REE) are of great interest, they interact with primary radiation defects creating electrically passive complexes such as <impurity + defect>. Thus they increase radiation stability of silicon.

The purpose of the given work was the investigation of effect of irradiation by γ-quanta ^{60}Co properties of silicon doped REE–by samarium, gadolinium and erbium. The doping of silicon was carried out by growth process. Concentration of REE – samarium, gadolinium and erbium in silicon according to neutron-activation analysis equaled $10^{14} \div 5 \cdot 10^{18}$ cm^2. Silicon doped by phosphorus - 15÷50 Ω·cm were used as control samples. The results of investigations were obtained from DLTS (deep level transient spectroscopy) measurements, Hall effect and electrical measurements on definition of a resistivity, lifetime of minority carriers of a charge and optically active of concentrations of oxygen and carbon. The optical recharge by the infrared light emitting diode (P=10 mV, λ=0,95 μm) was used for investigation of deep levels (DL) situated in lower half of band gap.

In control samples irradiated by the γ-quanta ^{60}Co with a dose $10^{16} \div 5 \cdot 10^{18}$ cm^{-2} formation DL was found in band, the parameters of which are well-known: A-, E-centers etc. Depending on a dose of an effect of irradiate in an energy spectrum of radiation defects in Si<REE> of essential changes, except for concentration is not observed. The deep levels concentration the E_c-0,17 eV and E_c-0,4 eV in Si<REE> is essentially reduced with respect control samples. The comparison the dose of associations of observable levels in irradiated n-Si<REE> with similar associations in control samples shows, that a velocity of introduction rate of radiation imperfections in samples containing REE much lower, than in control.

Thus the presence REE - samarium, gadolinium and erbium does not reduce in formation of new radiation imperfections in silicon.

Established that the doping of n-type silicon when growing by the by samarium, gadolinium and erbium raises radiation stability.

The obtained results are considered in complex with results on DLTS, infrared (IR)-absorption, measurement of values of a lifetime of minority carriers of a charge, and on the basis of the literary date.

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FEATURES OF THERMAL AND RADIATION DEFECT FORMATION IN SILICON DOPED WITH HOLMIUM

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The problems of defect formation in silicon are one of the actual problems in study of semiconductor materials and microelectronics, because the process of the fabrication practically of any semiconductor devices comprises different cycles of thermal processing. To modify the characteristics of silicon (increasing the photosensitivity, tenzosensitivity, changing of resistivity etc.), its doping with different impurities, influence with ionizing radiations that finally brings to the formation of different sort of defects.

In this work the results of complex investigations of thermal and radioactive defect formation in silicon doped with holmium are given. As investigated samples n-Si doped with holmium, and the control samples n-Si with identical electric parameters were used.