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New compositions for chemical polishing of $Cd_{1-x}Zn_xTe$ crystals

O.S.Galkina, N.N.Grebenyuk, M.V.Dobrotvorskaya, V.K.Komar, D.P.Nalivaiko, O.N.Chugai*

Institute for Single Crystals, National Academy of Sciences of Ukraine,
60 Lenin Ave., 61001 Kharkiv, Ukraine
*N.Zhukovsky National Aerospace University "KhAI",
17 Chkalov St., 61070 Kharkiv, Ukraine

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New compositions (KIO_3 solutions with lactic or citric acid additives) have been proposed for chemical polishing of X-ray and gamma detectors based on $Cd_{1-x}Zn_xTe$ (x = 0.1...0.2) semiconductor crystals. The detector characteristics obtained after treatment in the standard etchant (methanolic bromine solution) and in new-developed compositions have been compared. The detector surface elementary composition, surface recombination rate, I-V characteristic, and energy resolution were examined. The action of KIO_3 solutions with oxyacid additives has been found to change the crystal stoichiometry and the surface recombination rate of charge carriers to a lesser extent while being equivalent to the standard etching in other parameters. The proposed etchants do not contain highly toxic compounds and are safe to use.

Предложены новые составы для химической полировки детекторов рентгеновского и гамма-излучения на основе полупроводникового соединения $Cd_{1-x}Zn_xTe$ (x = 0,1...,2) — растворы KIO_3 с добавками молочной или лимонной кислот. Проведено сравнение характеристик детекторов после обработки в стандартном (раствором брома в метаноле) и разработанных травителях: элементного состава поверхности, скорости поверхностной рекомбинации, вольтамперных характеристик и энергетического разрешения. Обнаружено, что воздействие на кристалл раствора KIO_3 с добавками оксикислот в меньшей степени изменяет его стехиометрию и скорость поверхностной рекомбинации носителей заряда, а по остальным параметрам не уступает стандартному травлению. Предложенные травители не содержат высокотоксичных компонентов и безопасны в работе.

Semiconductor detectors are among the most widespread types of X-ray and gamma detectors (XGD). Today, those are under active investigation and improvement due to their favorable properties such as compactness, wide detectable radiation range, low energy consumption, direct conversion of the radiation energy into electric signals, operating possibility at room temperatures, high efficiency and energy resolution.

The hard radiation detectors of 0.01 to 1 MeV energy using the wide-band semiconductor $Cd_{1-x}Zn_xTe$ (x = 0.1...0.2) (CZT) is the latest advance in this field [1, 2]. Those are used in individual dosimeters, medical gamma cameras, sensors of space vessels, etc. The optimization of their technology, however, is still an actual problem today.

Usually to produce the CZT detectors single crystal plates mechanically polished and etched by methanolic bromine solution (standard etching) are used. Au or Pt contacts are deposed on the etched surface [3]. These procedures are necessary to bring the surface conductivity and the surface recombination rate of free charge carriers as closely as possible to the values of those parameters in the crystal volume. In prac-