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PROSPECTS FOR THE USE OF WIDE-BANDGAP A^{II}B^{VI} CRYSTALS IN PHYSICAL VALUE SENSORS FOR AEROSPACE TECHNOLOGY

Abstract: Crystalline semiconductor sensors have been widely used to address various challenges in the measurement of physical quantities, with crystalline silicon (Si) frequently selected as the sensitive material in sensor assemblies. This choice is largely driven by the mature silicon production technologies and the extensive understanding of its physical properties. However, the relatively narrow band gap of silicon (~1 eV) results in limited thermal stability in its electrical and photoelectric properties, restricting the use of Si-based sensors in high-temperature environments, such as aerospace applications.

Keywords: semiconductor, sensor, crystalline silicon, polarization, piezoelectrics, thermal stability.

It is well known that crystalline semiconductor sensors allow solving a wide range of problems in measuring physical values. For this purpose, crystalline silicon (Si) is most often used as the sensitive element of a sensor assembly. Such a choice of the material is determined by the high level of the silicon production technology and the advances in the study of its physical properties. However, the relatively small (about 1 eV) width of the band gap of silicon predetermines the low thermal stability of electrical and photoelectric properties of Si crystals. This significantly impedes the use of Si-based sensors in aerospace engineering.

As an alternative to silicon in sensors operating in a wide temperature range, it is proposed to use wide-bandgap crystals of the A^{II}B^{VI} group. It is noted that the main advantages of these crystals include a large band gap (up to 3 eV), a wider spectral range of transparency for electromagnetic waves, and the possibility of forming substitutional solid solutions. Moreover, the

crystals of this group are piezoelectrics. This allows using them to produce laser radiation power meters which also serve as optical elements [1].

It is substantial that by varying the chemical composition, one can achieve an optimal combination of optical and photoelectric properties of a solid solution. We'd like to note the possibility to realize all the physical effects on $A^{II}B^{VI}$ compounds that were formerly observed on silicon crystals [2]. More importantly, due to the wide band gap, these materials allow utilizing another effect when measuring various physical values — electrical polarization under the influence of a low-frequency field. Particularly, the measurement of the exposure dose of ionizing radiation can be realized based on this effect [3].

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