

right choice of the shape of the seed, and so on. Therefore, in the present paper we introduced the improvements beyond the present status of the top-seeded solution-growth method.

We modified the growth set-up by securing more homogeneous heating of the crucible bottom. This was achieved by adding a movable ferrite bar that could be inserted into the inductor. By adjusting the vertical position of the ferrite bar inside the radio-frequency-powered inductor, we controlled the extra currents in the conducting bottom of the crucible. As a result, the bottom was heated additionally and the temperature of the crucible bottom was tuned. By this we managed to lower thermal gradients within the crucible and to suppress spontaneous formation of unwanted crystallization seeds at the bottom of the crucible.

Bulk potassium tantalate single crystals were grown using this modified set-up. The crystals were studied by X-ray diffraction, Raman scattering, and magnetic resonance spectroscopy methods. All the characterization techniques have proven the high crystal quality and purity of the samples. Thus, the proposed modification of the growth set-up ensures production of KTaO_3 single crystals with properties in demand in multiple fields including electronic and optical industries as well as for the development of highly sensitive and compact radio-spectroscopic instruments.

REFRACTIVE, NONLINEAR OPTICAL, AND VIBRATIONAL PROPERTIES OF Na_2SO_4 CRYSTAL

**Rudysh M. Ya.¹, Brezvin R. S¹, Myronchuk G. L.², Jędryka J.³, Piasecki M.⁴,
Kordan V.M.⁵**

¹*Department of Experimental Physics, Ivan Franko National University of Lviv, 8 Kyrylo & Mephodiy Street,
79000, Lviv, Ukraine, e-mail: rudysh.myron@gmail.com*

²*Educational and Scientific Physical and Technological Institute, Lesya Ukrainka Volyn National University,
13 Voli Avenue, 43025, Lutsk, Ukraine*

³*Institute of Optoelectronics and Measuring Systems, Faculty of Electrical Engineering, Częstochowa University of
Technology, 17 Armii Krajowej Str., 42-200 Częstochowa, Poland*

⁴*Faculty of Science and Technology, J. Długosz University, Armii Krajowej 13/15, Częstochowa,
42-201, Poland*

⁵*Department of Inorganic Chemistry, Ivan Franko National University of Lviv, 8 Kyrylo & Mephodiy Street,
79000, Lviv, Ukraine*

Dielectric crystals find wide practical application in various electronic devices as their active and passive elements. Important properties characterizing these materials include their transparency in a wide spectral range, a large value of the band gap, the possibility of modifying properties by changing the composition, the possibility of using them as a matrix for various kinds of impurities, etc. Crystals of the A_2BX_4 group are promising representatives of dielectric materials that are actively studied. Previously, a number of studies have been conducted on the study of refractive [1], birefringent [2], piezo-optical properties [3] and band-energy structure [4] of crystals of this group.

An interesting and little-studied representative of this group of crystals is Na_2SO_4 . It is known that the crystal can exist in four phases, which, with decreasing temperature, undergo the following phase transitions: $\text{I} \rightarrow \text{II} \rightarrow \text{III} \rightarrow \text{V}$ [5]. At a temperature of 1156 K, the crystal melts.

The aim of this study is to elucidate the refractive, nonlinear optical, and vibrational properties of the Na_2SO_4 crystal using theoretical and experimental methods. The Na_2SO_4 crystal was synthesized by the method of slow solvent evaporation. The structure and composition of the

crystals were checked by XRD, EDS, and EDX methods. The obtained crystals are transparent, colorless, and have the shape of quadrangular biprisms. The refractive properties of the crystal in the spectral region 400-750 nm were investigated by the standard Obreimov method. It was shown that the crystal has the largest anisotropy of the refractive index in the middle of the optical spectrum. The refractive parameters of the crystal were analyzed, and the molar refractivities R_m and polarizabilities α_m of the crystal were calculated. The vibrational properties of the crystal were investigated theoretically and through infrared spectroscopy methods. The nonlinear optical properties of the Na_2SO_4 crystal were investigated by the Kurtz–Perry method at a fundamental wavelength of $\lambda = 1064$ nm. It was shown that the crystal has second harmonic generation. An increase in the fundamental beam power leads to an increase in the generation efficiency. It is shown that the introduction of a Mn impurity into the Na_2SO_4 crystal structure leads to a decrease in the SHG efficiency.

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STUDY OF THE INTERACTION BETWEEN SILVER NANOPARTICLES AND SUBSTRATE UNDER PLASMON RESONANCE

Smachylo Yuriy, Ilin Oleksandr, Mysyuk Yuriy, Bulavinets Tetiana, Yaremchuk Iryna
*Department of Electronic Engineering, Lviv Polytechnic National University, 12 S. Bandera St.,
79013, Lviv*

e-mail: iryna.y.yaremchuk@lpnu.ua

Metal nanoparticles, especially silver, demonstrate exceptional optical properties in the visible spectrum due to the phenomenon of localized surface plasmon resonance due to oscillations of free electrons under the influence of an external electromagnetic field [1]. These oscillations cause enhancement of local electromagnetic fields, which underlies applications such as biosensors, SERS, photonics, and optoelectronics. The properties of plasmon resonance can be finely tuned by changing the size, shape of nanoparticles, as well as their environment, particularly the substrate material. Despite active study of the influence of geometric parameters of nanoparticles, the influence of the substrate often remains overlooked, although it can significantly change the extinction spectrum of nanoparticles due to the induced field and near-field enhancement [2]. This paper presents a theoretical analysis of the influence of dielectric and metallic substrates on the optical response of silver nanoparticles depending on their size and distance to the surface. Calculations performed within the quasistatic approximation using the dipole image method show that substrates with high dielectric constants cause a shift of the extinction maximum towards longer wavelengths and enhancement of signal intensity, which is important for the development of effective plasmonic structures and devices.

The calculation results show a significant shift in the extinction peak and an increase in extinction cross-section values when changing the substrate material. Materials such as cellulose, indium tin oxide, and silver were studied. It was established that substrates with higher dielectric