Contribution ID: **151** Type: **Oral presentation**

Optical and luminescent properties of 40Ca100MoO4 single crystals

Monday, 18 September 2017 17:15 (15 minutes)

Calcium molybdate based crystalline materials show good potential for laser physics and acousto-optics due to a combination of a wide range of functional properties [1]. Currently these crystals are efficiently used as humidity sensors and optical elements of stimulated Raman scattering lasers.
Over the last decades there has been a growing interest towards CaMoO4 (space group 4/m, scheelite structure) because of its applicability as a material for cryogenic scintillation detectors [2]. Calcium molybdate crystals contain the 100Mo molybdenum isotope for which the possibility of neutrinoless double beta-decay (0ν2β) has been predicted, i.e. it can be used in the physics of elementary particles. Authentic registration of neutrinoless double beta-decay could allow the scientists to determine the weight of the neutrino which is one of the most important tasks of advanced nuclear physics. Efficient search for neutrinoless beta-decay requires a sensitive calcium molybdate functional elements with high optical and sufficient scintillation properties, and the contents of radioactive isotope impurities of the U-238 and Th-232 series should be at an low level. The low-background plant should be installed deep underground with the aim of reducing the radiation background generated by space radiation and carefully screened with the use of radiation free materials [3].
In Russia, 40Ca100MoO4 single crystals for the functional elements of this type of detectors are only grown by Fomos-Materials OJSC.
The main requirements of crystalline elements of the detector are absence of color and the attenuation coefficient (μ) not higher than 0.01 cm−1 at 520 nm wavelength (maximum scintillation luminescence) [3]. The results showed that the quality of the crystals is insufficient for the stated objectives because 40Ca100MoO4 crystals grown in air acquire blue color. The color of the crystals is caused by the color centers formed during the crystal growth [1].
Therefore it is crucial to study the attenuation spectra of the material as a function of growth conditions and subsequent treatment and to choose the optimum 40Ca100MoO4 crystal growth conditions, which provide the required material parameters.
Optical and luminescent properties of 40Ca100MoO4 single crystals have been investigated. The influence of isothermal annealing on the attenuation spectra in the 350 to 700 nm wavelength range has been studied. A broad absorption band with a maximum at λ=460 nm is observed in the attenuation spectra of the samples. The dichroism phenomenon which is associated with anisotropy of the color centers in the crystals is observed along directions perpendicular to the optical axis. We calculated the degree of dichroism. The results showed that oxidative annealing of the 40Ca100MoO4 crystals at high temperature initially substantially reduces the 460 nm absorption band intensity and the attenuation.

[1] A.A. Blistanov, Kristally kvantovoi i nelineinoi optiki [Crystals of Quantum and Nonlinear Optics], MISiS, Moscow, 2007 (in Russian).
[2] V.B. Mikhailik, H. Kraus, Cryogenic scintillators in searches for extremely rare events, J. Phys. D: Appl. Phys. 39 (2006) 1181–1191.
[3] O.A. Busanov, R.A. Etezov, M. Gavriljuk Yu, A.M. Gezhaev, V.V. Kazalov, V.N. Kornoukhov, V.V. Kuzminov, P.S. Moseev, S.I. Panasenko, S.S. Ratkevich, S.P. Yakimenko, Background radioactivity of construction materials, raw substance and ready-made CaMoO4 crystals, EPJ Web Conf. 65 (2014) 4. http://dx.doi.org/10.1051/epjconf/20136503002.

Primary author: Ms ANNA, Kozlova (NUST "MISIS")

Co-authors: Mrs EVGENIYA, Zabelina (NUST "MISIS"); Ms NINA, Kozlova (NUST "MISIS"); Dr OLEG, Buzanov ("Fomos-Materials" Ltd.); Dr DMITRY, Spassky (NUST "MISIS", 3Skobeltsyn Institute of Nuclear Physics, M.V. Lomonosov Moscow State University); Ms ANASTASIIA, Chernykh (NUST "MISIS")

Presenter: Ms ANNA, Kozlova (NUST "MISIS")

Session Classification: Applications

Track Classification: S04_Application 2 (Orals)