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# Growth of Li2MoO4 scintillating crystals for neutrinoless double beta-decay search

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Neutrinoless double beta decay search is one of the most significant tasks in nuclear and elementary particle physics. The detection of this process will provide information on such fundamental issues as the absolute neutrino mass scale, the type of neutrino hierarchy (normal or inverse), and violation of CP parity in the lepton sector. One of the supposed options is a process involving the emission of majoron ⊠ presumable candidate for dark matter components. Discovery of this process will immediately lead to the discovery of a new elementary particle – the majoron. All this, in turn, will lead to the important consequences in physics and astrophysics. The sensitivity of modern experiments to the half-life of nuclei has been brought to ˜ 1025–1026 years [A.S. Barabash, Int. J. Mod. Phys. A, 33 (2018) 1843001]. One of the most promising future experiments is the CUPID-Mo [E. Armengaud, E. Phys. J. C, 80(1) (2020) 44]. The CUPID Mo experiment is based on low-temperature scintillating bolometers with Li2100MoO4 crystals as detecting elements. Li2100MoO4 was chosen because of high molybdenum ratio and possibility of enrichment with molybdenum-100 (100Mo) isotope. Thus, developing techniques for obtaining large Li2MoO4 crystals of high optical quality becomes an important task in crystal growth field. The extreme rarity of double beta decay imposes strict requirements on crystal scintillators. In addition to the general requirements for scintillators - high optical quality, light output, energy resolution, the material must also contain a minimum amount of impurities and have an ultra-low radiation background. Above listed requirements make the low-thermal-gradient Czochralski technique (LTG Cz), developed at NIIC SB RAS, a unique technology for growing Li2MoO4 crystals. The method has significant structural differences from the conventional Czochralski technique, due to which the temperature gradients inside the heater are reduced by two orders of magnitude, to values less than 1 deg/cm. Due to this, the processes of volatilization of the melt components are suppressed, the loss of expensive isotopically enriched molybdenum-100 during growth is prevented, the amount of thermoelastic stresses and defects in the growing crystal is reduced. In presented work, an approach for growing Li2MoO4 crystals of high optical quality was developed. The approach implied conversion of growth parameters to establish normal growth mechanism instead of layered one traditionally implemented in LTG Cz. Optimal growth parameters were determined based on morphology and defects concentration in grown crystals. Reproducible growth of 120 mm long Li2MoO4 crystals was achieved, and 50 uniform crystals were obtained.

**Primary author(s) :** Ms. GRIGORIEVA, Veronika (aNikolaev Institute of Inorganic Chemistry, SB RAS); Dr. SHLEGEL, Vladimir (aNikolaev Institute of Inorganic Chemistry, SB RAS); BARABASH, Alexander (ITEP)

**Presenter(s) :** Ms. GRIGORIEVA, Veronika (aNikolaev Institute of Inorganic Chemistry, SB RAS)

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