

**LOW-TEMPERATURE THERMODYNAMIC PROPERTIES
OF SINGLE CRYSTALS OF DOUBLE ALKALI METAL MOLYBDATES**

Bespyatov M.A.⁽¹⁾, *Trifonov V.A.*⁽¹⁾, *Khokhlov N.A.*⁽²⁾, *Shevelev D.S.*⁽¹⁾,

Nazarova A.A.⁽¹⁾, *Kuzin T.M.*⁽¹⁾, *Gelfond N.V.*⁽¹⁾

⁽¹⁾ Nikolaev Institute of Inorganic Chemistry SB RAS

630090, Novosibirsk, Acad. Lavrentiev Ave., 3

⁽²⁾ Crystals of Siberia Ltd

630058, Novosibirsk, Russkaya st., 43

The development of cryogenic scintillating bolometers is a promising approach for the search for neutrinoless double beta ($0\nu 2\beta$) decay. In this context, significant efforts are currently focused on identifying and characterizing new scintillating materials. The performance of bolometers as thermal radiation detectors is governed by their sensitivity to temperature variations induced by particle interactions. Therefore, the heat capacity of the absorber material (i.e., the scintillating crystal) represents a key parameter in the design of bolometric detectors. In addition, heat capacity data over a wide temperature range provide valuable insight into the phase stability of the studied compounds as well as their thermodynamic functions. Adiabatic calorimetry remains the most accurate method for heat capacity measurements. In this work, we report, for the first time, a systematic investigation of the low-temperature thermodynamic properties of single crystals $\text{LiCsMo}_3\text{O}_{10}$, $\text{NaCsMo}_3\text{O}_{10}$, $\text{LiRbMo}_3\text{O}_{10}$, LiCsMoO_4 , LiRbMoO_4 , LiKMoO_4 , $\text{LiNa}_5\text{Mo}_9\text{O}_{30}$, and $\text{Cs}_3\text{Na}(\text{MoO}_4)_2$.

The investigated molybdate single crystals were grown using spontaneous crystallization from the melt and the low-thermal-gradient Czochralski technique. Prior to calorimetric measurements, all samples were thoroughly characterized: the phase and elemental compositions were confirmed, and trace impurity levels were determined, with the total impurity content not exceeding 0.02 wt%. High-precision heat capacity data for single-crystal samples were obtained using adiabatic calorimetry over the temperature range of ~6 to ~320 K with a BKT-20 calorimeter. The heat capacity curve of LiCsMoO_4 exhibits two anomalies with maxima at $T_{c1} = 171.5$ K and $T_{c2} = 208.9$ K, associated with first-order phase transitions. No anomalies in heat capacity behavior were observed for the other studied compounds. Based on the measured heat capacity data, thermodynamic functions were calculated over the temperature range 0–320 K. The results indicate that the $\text{LiNa}_5\text{Mo}_9\text{O}_{30}$ single crystal is the most promising candidate for use as a scintillating material in cryogenic bolometers developed for neutrinoless double beta decay experiments. It offers several advantages over the widely used lithium molybdate Li_2MoO_4 , including its non-hygroscopic nature, higher molybdenum content, and a higher Debye temperature at 0 K (337.0 K for $\text{LiNa}_5\text{Mo}_9\text{O}_{30}$ versus 316.15 K for Li_2MoO_4).

The study was supported by a grant from the Russian Science Foundation No. 24-19-00405, <https://rscf.ru/en/project/24-19-00405/>