

Mass production of enriched $\text{Li}_2^{100}\text{MoO}_4$ crystals with high purity levels

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Neutrino oscillation experiments have shown that neutrinos have mass. However, the results haven't provided absolute masses and properties of neutrinos. Many experimental groups have conducted experiments to address these questions. One of the experimental groups is the Advanced Mo-based Rare Process Experiment (AMoRE), which searches for neutrinoless double-beta decay of ^{100}Mo isotopes in scintillation crystals at mK temperatures. Since the decay is very rare, it is extremely important to keep the radioactive background levels of the crystals.

The Center for Underground Physics (CUP) at the Institute for Basic Science (IBS) has conducted ultra-pure Li_2MoO_4 (LMO) crystal growth for the AMoRE. After growing natural LMOs of various materials by the Czochralski method, we assessed the purity of each crystal using ICP-MS at CUP. The values of the main impurity elements of the internal crystal to be measured were below the ppb level, and a few major elements were lower than the detection limit of the ppt level.

We also investigated natural LMO crystals to determine the optimal growth conditions for CUP facilities. The ingot size of the grown LMO crystals is approximately 50 mm (\varnothing) \times 140 mm (H), and the weight is approximately 600 g in the current facility. With this consistent work, we handle only the body of the ingot, which is used in actual detectors (Weight: about 300 g, half of the ingot). The remaining parts were reused as the basis for regrowth material.

Recently, we have begun mass production of enriched $\text{Li}_2^{100}\text{MoO}_4$ crystals for use in the AMoRE detector. The crystal ingots cannot be used directly as the detector; they must undergo multiple processing steps in accordance with the detector's design. We also sought to minimize contamination during machining.

We report on the overall growth and handling of Li_2MoO_4 crystals at CUP for mass production.

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