

PURIFICATION TECHNIQUES OF MoO₃ FOR AMoRE EXPERIMENT

Friday 6 July 2018 20:15 (15 minutes)

The Advanced Mo based Rare process Experiment (AMoRE) is a series of experiments focused on searching for the neutrinoless double beta ($0\nu\beta\beta$) decay of ^{100}Mo . Molybdenum based single crystals of high purity are used as scintillating elements of detector. Sensitivity of the AMoRE detector is limited by the background in the region of the expected peak, the main source of the background forced due to decay chains of natural isotopes, mainly Ra, Th and U presenting as impurities in detector material.

For the all molybdenum-based crystals, molybdenum trioxide powder is used as a main initial material for crystal growth. The MoO₃ is volatile at temperatures below melting point, so sublimation at temperature range of 700-720 C under low vacuum allows remove main contamination. By the way, after successive double sublimation raw MoO₃ at 720 C Th and U contamination significantly reduced below 20 ppt and 130 ppt levels, respectively. Combination of double sublimation and wet chemistry techniques, like co-precipitation followed by complete precipitation of polyammonium molybdates from acidic media, provides deep removal of many elements. After annealing in air environment Th and U concentration in the purified MoO₃ powder decreased below detection limit 10 ppt.

In order to measure lower concentration and decrease the detection limit, development of analytical method for measurement of high purity inorganic materials, like MoO₃ and other molybdenum based crystals, by ICP-MS in tandem with solid-phase separation is going on.

The presented techniques shown high effectiveness for raw MoO₃ purification and could be used for purification of enriched powder, moreover, it might be helpful for the other projects which are using pure MoO₃.

References:

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- Gileva, O., Aryal, P., Karki, S. et al. J Radioanal Nucl Chem (2017) 314: 1695.

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Session Classification: POSTER