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MoO3 purification for searching on neutrinoless double beta decay for AMoRE

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The AMoRE (Advanced Mo based Rare process Experiment) is searching for neutrinoless double beta ($0\nu\beta\beta$) decay of 100Mo using radiopure molybdate-based crystals. 100Mo is one of the favorite isotopes in searches for $0\nu\beta\beta$ decay due to high energy release, $Q\beta\beta$=3034 keV and quite large natural abundance, 9.82%. Since there are no commercially available molybdenum compounds with required purity levels, one of the important stages of the program is the deep purification of initial materials which intended to reduce the internal radioactive contamination. This study discusses approaches to purify initial Molybdenum Oxide 99.95 % purity grade. A double sublimation, fractional crystallization and co-precipitation from aqueous solution were used as purification methods. The other important requirements for the study are its high performance, high efficiency of purification and minimal irretrievable losses of material. In order to check effectiveness of purification, concentrations of impurities (Sr, Ba, Pb, Th and U) were measured by ICP-MS and radioactivity was checked by HPGe detectors at Yangyang underground laboratory in Korea.

Summary

The purification method presented in this report have shown good separation of Sr, Ba, Pb, Th and U from initial molybdenum oxide powder with high recovery yield for final product. Moreover, sublimation and recrystallization do not require the use of large quantities of expensive ultrapure reagents. At present time, this study is ongoing to improve data and search advanced purification method.

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