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# Search for new Molybdenum based crystal scintillators for neutrino-less double beta decay search

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Absolute masses and Majorana nature of neutrinos can be revealed if neutrino-less double beta decays are observed. To achieve enough sensitivity for the extremely rare events, it is required to have detection techniques capable of distinguishing extremely rare signals over a significant radioactive background from both inside and outside of the detectors. One of the most promising techniques is a cryogenic phonon-scintillation detector at a milli-Kelvin temperature using both photon and phonon signals by an event by event basis discrimination of the extremely rare signal from the huge backgrounds.

The AMoRE [1] and LUMINEU [2] collaborations are searching for the extremely rare event process of neutrinoless double beta decay (0v2β) of 100 Mo isotopes using CaMoO4, ZnMoO4 and LiMoO4 crystals,respectively. Main advantages of the 100 Mo are its high transition energy (Q ββ = 3034 keV) and a relative easiness to enrich. However, since the above crystals either have low light outputs, difficult to grow, or purification limitations, it is necessary to search for new Mo based crystals with better performances for the AMoRE-II and other next generation experiments.

We studied Li2O-MoO3, Cs2O-MoO3 and Na2O-MoO3 phases and have developed several new crystals grown by a Czochalski method. The syntheses of polycrystalline materials are discussed based on the TGA/DSC analysis and the crystal structures are reported based on the XRD analysis. Luminescence and scintillation properties such as emission spectrum, light yield and decay time of the crystals from a room temperature to 10 K were studied by exciting the crystal samples with a 280 nm pulsed LED or a beta source. Developed crystals are not luminescent at the room temperature but luminescent at the cryogenic temperatures and the decay time got longer. We studied Li4Mo5O17, Li2Mo4O13 (Li2O-MoO3), Na2Mo2O7, Na6Mo11O36 (Na2O-MoO3), and Cs2MoO4, Cs2Mo2O7, Cs2Mo3O10 (Cs2O-MoO3) crystals. Among those newly developed Mo-based crystals, the Na 2 Mo 2 O 7 crystal shows one of the most promising properties for the neutrino-less double beta decay search experiments.

[1] V. Alenkov et al., arXiv:1512.05957v1, 18 Dec 2015.

[2] http://lumineu.in2p3.fr/

## Has accepted

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