



Contribution ID: 276

Type: Poster

Development of liquid scintillator containing zirconium complex for neutrinoless double beta decay experiment

An organic liquid scintillator containing zirconium complex was studied for neutrinoless double beta decay experiment. A ^{96}Zr nuclei has a large Q-value (3.35MeV), and no experiment is planned to use as a target. In order to realize ton scale target isotope with good energy resolution (4%@2.5MeV), we have used zirconium beta-diketon complex which has huge solubility (over 10wt.%) to the Anisole. However, the absorption wavelength of diketon ligand overlaps with the luminescence from Anisole. Therefore, the light yield of liquid scintillator decreased in proportion to the concentration of beta-diketon complex. In order to avoid this problem, we synthesized beta-keto ester complex introducing -OC₃H₇ or -OC₂H₅ substituent groups in the beta-diketon complex. These complexes have shorter absorption wavelength (245nm) than the emission wavelength of Anisole (275nm). The scintillation light yield recovered about double, however, did not reach at the expected value, because the residual absorption around 275nm still existed. We have found that those were caused by the impurities of beta-keto ester complex and it will be solved by purifying the complex such as the sublimation. We have also found that a diethyl malonate ligand shifted the absorption peak to around 210nm, and the complex will have no quenching for the Anisole based liquid scintillator. Here we will report the present status.

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Track Classification: Experiments: 2c) Detectors for neutrino physics