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

An organic liquid scintillator containing zirconium complex was developed for new neutrinoless double beta decay experiment. In order to realize the ton scale of target isotope with good energy resolution (4% at 2.5MeV) and low background environment (0.1 events/ton/year), we have chosen zirconium beta-diketon complex which has huge solubility (over 10w.t.%) to Anisole. However, the absorption peak of diketon ligand overlaps with the luminescence of anisole. Therefore, a light yield of the 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 beta-diketon ligand, and succeeded to move the absorption peak to around 245nm, which is shorter than the emission peak of Anisole (275nm). However, the shift of absorption peak depends on the polarity of used solvent. Therefore we are going to test low polarity solvent for the liquid scintillator.

We have also synthesized Zr-ODZ complex, and succeeded to have large quantum yield (30%) and good emission wavelength (425nm) with a solubility 5w.t.% for Benzonitrile. However, the absorption peak of Zr-ODZ complex was found around 240nm. Therefore, we are going to use the scintillation solvent which has shorter wavelength of the luminescence than that of an aromatic solvent. In this talk, we will report new results of liquid scintillator containing zirconium complex, and the performance for measurement of neutrino double beta decay.

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