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

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An organic liquid scintillator containing zirconium complex was studied for neutrinoless double beta decay. We have synthesized tetrakis(8-quinolinolate) zirconium as a complex and found their good solubility (2 w.t.%) in Benzonitrile, which has good light yield of primary scintillation for gamma-rays. The photo-luminescence was measured, and the maximum peak was found around 548nm. We made liquid scintillator cocktail using both PPO and POPOP, and measured energy spectrum from induced gamma rays. However, the light yield was very small. In order to shorten emission wave length, we introduced Dimethoxy-Tiazine as substituent group, and succeeded to obtain larger quantum yield and light yield than those of original complex. We are developing another zirconium complex. Zirconium beta-diketon complex has a huge solubility (over 10w.t.%) for anisole, however, it does not have a luminescence, and the absorbance of ligand overlaps with the luminescence from anisole. Therefore, the light yield should be weaker as proportional to the concentration of complex. In order to avoid this problem, we are planning to synthesize beta-keto ester complex with -OC₃H₇ or -OC₂H₅ substituent groups. These complexes have much shorter wavelength of the absorbance than the emission of anisole. We are also synthesizing Zr-ODZ complex, which should have both large quantum yield and good emission wave length. Here we report these new ideas of liquid scintillator containing zirconium complex.

quote your primary experiment

SuperKamiokande, XMASS, T2K

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