

RADIOPURE ZnWO₄ CRYSTAL SCINTILLATORS FOR DOUBLE BETA DECAY EXPERIMENTS

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Zinc tungstate (ZnWO₄) was proposed as perspective material for the low-counting experiments to search for double beta (2 β) decay of zinc and tungsten isotopes twenty years ago [1]. The first low-background measurement with the small ZnWO₄ sample (mass of 4.5 g) was performed in the Solotvina Underground Laboratory (Ukraine) at a depth of ≈ 1000 m w.e. [2].

A high sensitivity experiment to search for 2 β processes in Zn and W isotopes has been performed in the underground Gran Sasso National Laboratories of the I.N.F.N. (Italy) at a depth of ≈ 3600 m w.e. Three large volume (117 g, 239 g, and 699 g) radiopure ZnWO₄ crystal scintillators (one produced in the Nikolaev Institute of Inorganic Chemistry, and two in the Institute for Scintillation Materials) were used in the low-background measurements. The total time of data taking exceeds seventeen thousands hours. Low level radioactive contaminations of ZnWO₄ samples were estimated with the help of time-amplitude analysis, pulse-shape discrimination and by fitting of background spectra. The activities of ²²⁶Ra and ²²⁸Th do not exceed a few μ Bq/kg, while the total α activity of nuclides from U/Th families is at the level 0.2–0.8 mBq/kg. New improved half-life limits on different channels of 2 β processes in ⁶⁴Zn, ⁷⁰Zn, ¹⁸⁰W and ¹⁸⁶W have been established at the levels $T_{1/2} \approx 10^{18}$ – 10^{21} yr. Preliminary results of this work have been published in [3, 4].

References

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