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A Sensitive Assay Technique for 210Pb In Water Developed For The SNO+ Experiment

SNO+ is a multipurpose neutrino physics experiment, located 2 kilometers underground in the SNOLAB facility in Sudbury, Canada. It is the successor of the SNO experiment, replacing the heavy water in the Acrylic vessel (AV) with 780 tonnes of liquid scintillator, Linear Alkyl Benzene (LAB). The AV is surrounded by 7000 tons of ultrapure light water, which shields the detector from naturally occurring radioactivity in the surrounding rock, PMTs, and PSUP. To achieve the radiopurity requirements, the water should be very clean and levels of U and Th contamination in the shielding water must be carefully controlled. A water assay technique, based on the capture of Ra and Th radioisotopes using Hydrous Titanium Oxide (HTiO), was developed by the SNO experiment. Ra sensitivities equivalent to 232Th: 4 x 10ˆ-16 gTh/gD2O and 238U: 3 x 10ˆ-16 gU/gD2O were achieved with this technique (NIM A 604: 531-535 (2009)). The HTiO technique will be used in SNO+ to monitor 238U and 232Th contamination levels in the shielding water and the performance of the water purification system.

For the lower energy measurements of interest to SNO+, radon daughter radioisotopes, especially 210Po and 210Bi supported by 210Pb, are also important. Since water will be used in the purification of both the liquid scintillator and tellurium that will be chemically loaded in SNO+ to search for neutrinoless double decay, a technique to assay for 210Pb in water was desirable. The SNO+ collaboration has extended the HTiO assay technique to allow measurement of 210Pb in the water. This technique is capable of measuring 0.4 +/- 0.13 mBq/mˆ3 of 210Pb for a 10 tonne assay. The measured background of the SNOLAB underground HPGe well detector is 0.8 +/- 0.3 mBq. The method developed and results of initial 210Pb measurements are presented.

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