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Studies of bulk 210Po/210Pb contamination in high purity copper for low-background detectors

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Surface and bulk contamination with long-lived daughters of ^{222}Rn is of great interest for most of the experiments looking for rare events. These include detection of low energy solar neutrinos, searches for neutrinoless double beta decay or searches for dark matter. Decays of ^{210}Pb, ^{210}Bi and finally ^{210}Po may contribute significantly to the experiments' background directly by the generated radiation, or indirectly through e.g. production of neutrons in the (,n) reactions. The latter is of special interest for the dark matter experiments as the interactions of neutrons are indistinguishable from the interactions of dark matter particles.

Direct detection of the long-lived part of the ^{238}U chain is necessary because of possible disequilibrium in the chain. One cannot conclude about the ^{210}Pb-^{210}Po specific activities form the ^{226}Ra or ^{238}U activities measured with high-sensitivity gamma-ray spectrometers or ICP-MS instruments, respectively.

A method to measure ^{210}Po in copper will be discussed. Copper, because of its high radio-purity, is widely applied in low-background experiments as a shielding material and it is also often used to fabricate support structures of sensitive detectors. By separation of ^{210}Po from the bulk material and subsequent counting of its activity it is possible to achieve the detection limit at the level of 10 mBq/kg. For a selected copper sample (material purchased for shielding of low-background gamma spectrometer) a relation between ^{226}Ra (determined by application of high-sensitivity gamma spectrometry), ^{210}Po and ^{210}Pb (specific activity established form the ^{210}Po decay profile) indicating a strong radioactive disequilibrium, will be discussed.

Reference to paper (DOI or arXiv)

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