LOW RADIOACTIVE NH_4Cl FLUX

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Solder wire connection remains the basis of reliable contacts. This is relevant for experiments that require minimizing the amount of structural materials, such as searching for and investigating rare phenomena in low-background environments. At the same time, despite the minimum quantities used, the solder and flux must meet the requirements of radioactive purity. The report about radioactive-less solder [1] depicts a problem with unacceptable radioactive contamination of commercially available fluxes.

In this work we report production of low-radioactive NH_4Cl inorganic flux from highly purified components. $NH_3 + HCl \rightarrow NH_4Cl$ reaction was chosen for synthesis as satisfying to the two main requirements: the minimum quantity of initial components with higher purity can be used and simplicity of implementation. Main stages of the production were: 1) purification of the acid; 2) transfer of gas phase ammonia to the acid (synthesis of ammonium chloride solution); 3) obtaining NH_4Cl in a solid state by drying in a vacuum under room temperature. All the processes were performed in a clean room (JINR, Dubna) with using chemically resistant vessels made from radio-pure materials. The final product obtained is a dry salt of ammonium chloride in form of white granules. A pure HCl mass of 250 grams and 500 grams of NH_4OH were used to obtain 80 grams of the salt.

A γ-ray spectrometry screening has been performed to estimate the radioactivity level of the final product with a sample of 50 grams of ammonium chloride. An ultra-low background HPGe n-type detector (210 cm^3), part of the EDELWEISS experiment [2] infrastructure in the LSM underground laboratory, was used for these purpose. The detector sensitivity is on a level of mBq for main natural radio-isotopes (U/Th/K). After 35 days of counting, no detectable excess was observed above the detector internal background. An ICP-MS elemental analysis also did not reveal the presence of any unexpected admixture to the synthesized ammonium chloride.

Given the successful results on the tested solders made using the home-made ammonium chloride salt as the flux, the objective of creating a low-radioactive flux was achieved.

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1. D.S.Akerib *et al.* // NIM A. 1997. V.400. P.181.
2. E.Armengaud *et al.* // JINST. 2017. V.12(08). P08010.