

## **PREPARATION OF THE Sn(60%)Pb(40%) SOLDER ON THE BASIS OF ARCHAEOLOGICAL LEAD**

Temerbulatova N.T.<sup>1,2</sup>, Filosofov D.V.<sup>1</sup>, Karaivanov D.V.<sup>1,3</sup>, Mirzayev N.A.<sup>1,4</sup>,  
Ponomarev D.V.<sup>1</sup>, Rakhimov A.V.<sup>1</sup>, Rozov S.V.<sup>1</sup>, Yakushev E.A.<sup>1</sup>

<sup>1</sup> Joint Institute for Nuclear Research, Dubna, Russia; <sup>2</sup> Institute of Nuclear Physics, Almaty, Kazakhstan; <sup>3</sup> Institute for Nuclear Research and Nuclear Energy (Bulgarian Academy of Sciences), 72 Tzarigradsko chaussee, Blvd., BG – 1784 Sofia; <sup>4</sup> Institute of radiation problems of the National Academy of Sciences of Azerbaijan, Baku, Azerbaijan  
E-mail: tnargiza@jinr.ru

Modern experiments with aim of investigation or search of ultra-rare events, for example neutrino or Dark Matter interaction within a low background detector, places high demands for the radiation purity of the materials used, even for those used in small quantities. These include materials used for soldering elements in detector systems, i.e. a solder and flux. Radioactive purity of the materials is crucially important since their location in a close proximity to the detector's body inside of the shields. Radionuclide purity of commercial solders does not meet the requirements because they are made of natural lead which contains the radioisotope <sup>210</sup>Pb ( $T_{1/2} = 22.3$  y.) on a level of 1÷100 Bq/kg. Therefore, it is advisable to manufacture a solder based on archaeological Roman lead that does not contains the <sup>210</sup>Pb since its activity decreased by 1000 times each 220 years.

In this work we report on production of solder made from the raw archaeological lead [1] which chemical purity investigation performed in [2] and commercial tin of high purity (99,9999%) [3]. Melange of the solder components has been performed in a crucible made from beryllium oxide that radionuclide purity verification been performed in advance by gamma-ray screening with HPGe low background spectrometer. Two ingot tin-lead solders with a mass of 100 grams each were produced. The solder composition is: 60% of Sn and 40% of Pb. In addition, a sample of the same weight made from usual lead and high purity tin was also produced for intercomparison measurements. The work on the production of the solder was carried out in a specially equipped clean room in JINR (Dubna). The solder ingots were transferred to the Modane underground laboratory for further measurements of their radioactivity levels.

1. Michel L'Hour // Rev. Archéol. de l'Ouest. V.4. 1987. P.113.

2. Petr S.Fedotov *et al.* // Talanta. 2019. V.192. P.395.

3. Tin with chemical purity 99.9999% purchased from the “URAL-OLOVO” metallurgical company.