COMPLEX OF EQUIPMENT FOR PREPARATION OF HIGH-QUALITY RADIOACTIVE SOURCES USED IN PRECISE NUCLEAR SPECTROSCOPY

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Precise investigations of spectra from nuclear radiations are quite sensitive to quality of radiation sources used. In an ideal case a source should introduce no noticeable distortion into registered spectrum. In spectroscopy of low-energy gamma quanta, electrons and alpha particles sample preparation quite frequently turns to be a challenging independent scientific investigation. Source preparation is conventionally performed at two stages – extraction of activity from a target and its uniform distribution over a substrate. A general requirement to such radioactive layer is maximal total and specific activity.

The paper introduces a complex of experimental equipment for preparation of high-quality radioactive sources. This complex is arranged in a well-protected heavy box equipped with master-slave manipulators. Biological protection of the box makes it possible to handle activities up to 10^{11} Bq. Main part of the complex is a special vacuum post that assures works with active samples in the vacuum up to 10^{-7} mm Hg – the operations include fractional sublimation, thermal evaporation, thermal diffusion, evaporation by electron beam, etc. All units of the vacuum post arranged in the box are designed to work with master-slave manipulators. The post is mainly used for preparation of a high-quality beta sources and extraction of microamounts of radionuclides from reactor and cyclotron targets by the method of fractional sublimation. Another important unit of the complex is an equipment for selective chemiosorption in vacuum. Complex comprises all required auxiliary equipment. The entire complex operated at high rate of reliability.

The paper pays particular attention both to systematization of available data on application of fractional sublimation and to consideration of a range of important issues regarding the mechanism of this process in order to optimize the procedures for preparation of radioactive sources for precise nuclear spectroscopy. Employing the method of fractional sublimation at the complex there were produced the following high-quality sources: ^{101}Pd, ^{105,106,111}Ag, ^{107,111}Cd, ^{131}J, ^{131,136}Cs, ^{194}Au and ^{209,210,211}At. The works on obtaining highly active sources for measurements of important low-intensity spectra of three-electron Auger transitions are in progress [1].

1. M.I.Babenkov, K.K.Kadyrzhanov, V.S.Zhdanov // LIII International Meeting NUCLEUS-2003". 2003, P.253 (in Russion).