CHROMATOGRAPHIC SEPARATIONS OF POLONIUM AND TELLURIUM AND PRODUCTION OF POLONIUM SOURCES FOR DRIFT CHAMBERS

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A new method of absolute measurements of the electron drift velocity in drift chambers has been recently developed at LNPI [1]. The electron drift velocity is measured by detecting α-decay recoils in a drift chamber in coincidence with α-particles registered with a Si detector.

Here we describe briefly some radiochemical experiments for production of α- and α-decay recoil sources from polonium-208, 210 isotopes. These isotopes were produced by means of the nuclear reactions $^{209}Bi(p,2n)^{208}Po$ and $^{209}Bi(n,\gamma)^{210}Bi \xrightarrow{\beta^-} {}^{210}Po$ by irradiating metallic Bi with 20 *MeV* protons and thermal neutrons, respectively.

The known methods of direct separations of Po from irradiated Bi targets are labor — intensive and not effective well enough [2]. Therefore we have used an indirect method of separation Po from Bi, which includes a quantitative coprecipitation of Po with Te from solutions and a chromatografic separation of these elements.

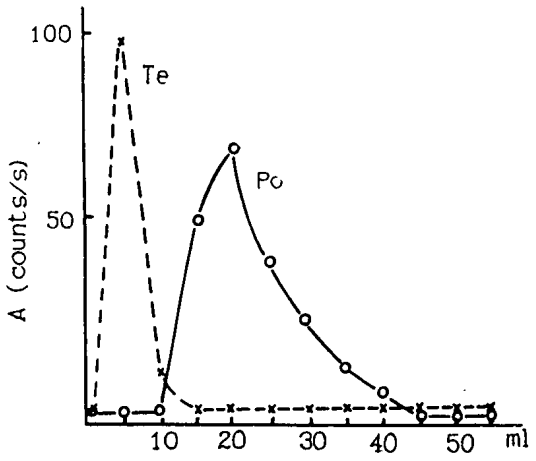

Fig.1. Separation of Po and Te by anion exchange

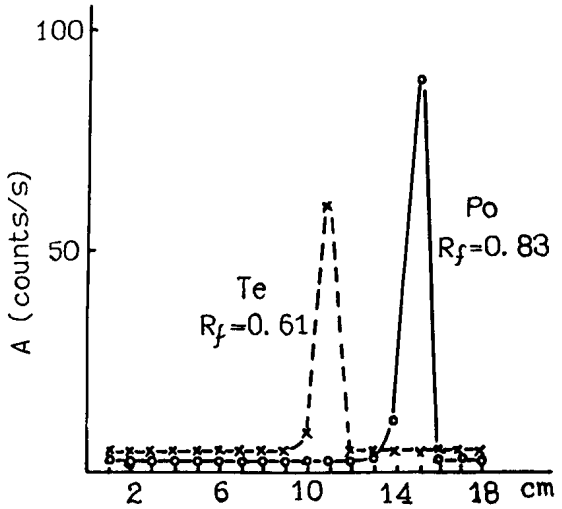

Fig.2. Separation of Po and Te by paper chromatography

The efficiencies of chromatografic separations were checked by registration of α-activity of Po isotopes and γ-activity of ^{125m}Te isotope, which had been added to natural tellurium.

The dissolutions of irradiated Bi targets were carried out in a mixture of HNO_3 and HCl in the presence of some mg of TeO_2. Then HNO_3 was removed by boiling with conc. HCl and Te(Po) as elements were precipitated from the solutions with a hot solution of $SnCl_2$ in HCl with subsequent washings with HCl and H_2O. The Te(Po) precipitate was dissolved in HNO_3 (1:3) and HNO_3 was removed by boiling with conc. HCl. The obtained solutions contained complex anions $Te(Po)Cl_6^{2-}$ and were used for anion exchange chromatografic separations of Te and Po.

The separations were performed on anion exchange resin ARA-8p (fraction 0.25—0.50 *mm*). A coloumn for the chromatography was of 6 *mm* for inner diameter and 80 *mm* for length.

Fig.1 represents the elution curve after sorption on the resin of ^{125m}Te(IV) (^{210}Po) solution in conc. HCl; eluent is HNO_3(1:1) with a rate of passing 12 drops/min; the residual retention of Po on the resin is less than 1%.

The quantitative separation of Po and Te at the same conditions can be achieved by using 2N HCl and HNO_3(1:1) as eluents. In this case Te can be completely washed out from the resin by passing 20 *ml* of 2N HCl; Po is extracted by subsequent elution with 25 ml of HNO_3 (1:1); the residual retention of Po on the resin is $\leq$4%.

The separation of Po and Te in anion exchange experiments is evidently a result of high stability of $PoCl_6^{2-}$ complex anion at high concentrations of HCl. It was shown, that for the reaction $PoCl_4 + 2Cl^- \rightleftarrows PoCl_6^{2-}$ $K = 10^{14}$ [3].

Paper chromatography can be also succesfully used for separation of Po and Te. It is clearly seen from fig.2. We have used an ascending version of paper chromatography (paper FN-16; eluent is n-butanol, saturated with 3N HCl). In this case the starting solution for separation is Te(IV) (^{208}Po) in HNO_3(1:3) with an equal volume of conc. HCl.

The ^{208,210}Po sources for drift chambers were produced by spontaneous deposition of Po on Cu. After separation of Po by the paper chromatography Po was extracted from the strips of the paper with hot 0.6N HCl. This solution was used for spontaneous deposition of Po on Cu foil ($\leq 5\,\mu m$) at 60—80° *C* for 30—60 seconds.

The experiments have shown a high precision of the measurements of electron drift velocity when using these sources [1].

References

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