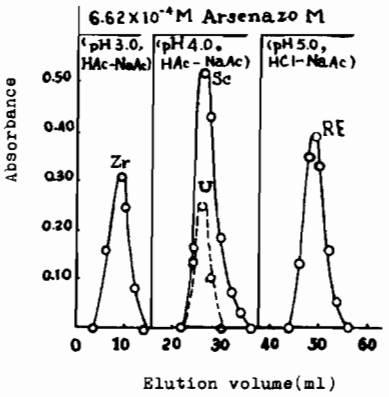

Fig. 3. Elution curve of Zr–Sc (or U–RE).

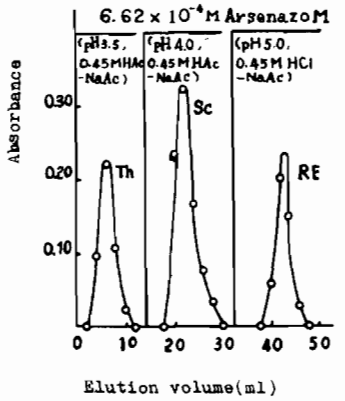

Fig. 4. Elution curve of Th–Sc–RE.

According to the experimental results the complete separation of the ternary mixtures may be achieved by a column (0.8 cm × 10 cm). The flow rate was 0.5–1.0 ml/min. The elution was carried out at room temperature.

Procedure of column separation: Solution of mixture of Zr/Sc(U)/RE (or Th/Sc/RE) added to the column. Elution was carried out with Arsenazo M in the different media and pH. Elution curves for these mixture are given in Fig. 3 and 4. The metals were directly determined by spectrophotometry. The spectrophotometric determination of each element is presented in the literature [5].

The results of percentage recovery are shown in Table I.

The method was applied to the analysis of Th (0.017–0.17%), Sc (0.005–0.13%), and RE (0.6–2.9%) in ore samples with satisfactory results

1 F. W. F. Strelow, *Anal. Chem., 32*, 1185 (1960); *37*, 106 (1965); *38*, 127 (1966).
2 K. S. Chung *et al.*, *Anal. Chim. Acta, 28*, 1 (1963).
3 P. Radhakrishana, *Anal. Chim. Acta, 6*, 351 (1952); *8*, 140 (1954).
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E31

Thermochromatographic Studies of the Heaviest Actinides

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The latest Dubna studies on the thermochromatographic behaviour of lanthanide and actinide elements in metallic columns are reviewed. At a very low concentration of oxygen in the carrier gas (He, Ar) and in the column material, under certain conditions, lanthanides and actinides form adsorption zones at about 600 °C in Ti columns. The deposition temperature increases beyond 1200 °C with increasing oxygen content. No separation of the elements has practically been observed. The chemical transport of gaseous lower oxides seems to be responsible for the behaviour of the elements under study in the presence of just minute quantities of oxygen.

When oxygen is practically removed by the addition of some calcium vapours to the carrier gas, those lanthanides and actinides known to be divalent metals are deposited in Ti columns at 500–600 °C, at the same time as the trivalent metals—at considerably higher temperatures. This can be understood if the elements are present in the atomic state and their valency in the adsorbed state is the same as that of the metals [1]. These regularities offer some prospects for the experimental study of the metallic valency of element 102. The basic scheme of such an experiment with the short-lived $^{252}102$ ($T_{1/2}$ = 3s, 30% SF) on a beam from a heavy ion accelerator is discussed. The necessary experimental conditions are chosen from experiments with some Yb tracers.

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E32

Determination of Trace Rare Earth Impurities in High-purity Yttrium Oxide by Using Ion-exchange Separation and Spectroscopic Method

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Since the sensitivity of direct emission spectroscopic method is not enough to analize rare earth impurities in high-purity rare earth oxides, a separation and pre-concentration step is always required. In the present paper, a cation exchange spectroscopic method is described. α-Hydroxyisobutyric acid is used as an efficient eluant to separate La, Ce, Pr, Nd,

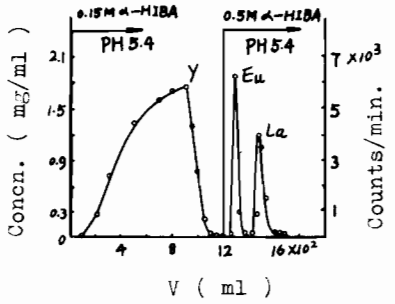

Fig. 1. Comparison of resin properties. o porous resin (200 mesh), x Zerolit 225 (200–400 mesh).

Sm and Eu from matrix yttrium. The concentrate is then determined by using solution dry-residue method. The detection limits are located in the range of 0.008 to 0.03 ppm (for a concentration factor of 10 000), and the variation coefficients are from 12 to 15%.

Ion-exchange Separation and Pre-concentration. α-Hydroxyisobutyric acid (α-HIBA) is an excellent eluent for the separation of Lanthanon [1]. Therefore, we selected α-HIBA as an eluent to separate La, Ce, Pr, Nd, Sm and Eu from matrix yttrium. In order to indicate the separation process, Eu (152, 154)

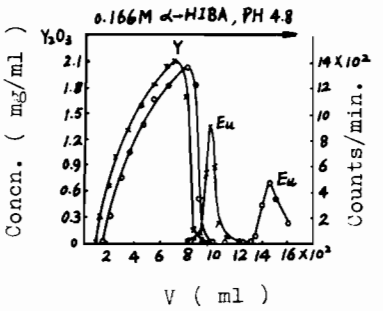

Fig. 2. Separation of La–Eu from yttrium.

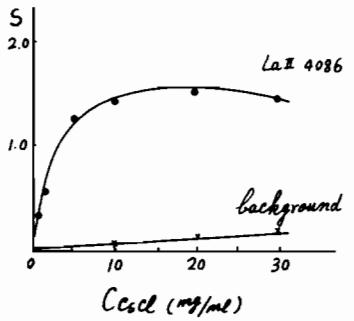

Fig. 3. Influence of CsCl.

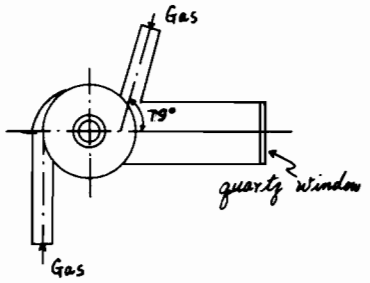

Fig. 4. Gas-chamber (quartz).

TABLE I. Sample Analysis Results.

Element	Present μg/g	Added μg/g	Total μg/g	Found μg/g	Recovery %	Average %
La_2O_3	0.08	0.1	0.18	0.14	78	91
	0.45	0.25	0.70	0.72	103	
	0.46	1.00	1.46	1.45	99	
	1.30	2.50	3.80	3.20	84	
CeO_2	0.20	0.50	0.70	0.60	86	96
	0.96	0.25	1.21	122	101	
	1.71	1.00	2.71	2.75	101	
	4.30	2.50	6.80	6.60	97	
Pr_6O_{11}	0.05	0.40	0.40	0.36	90	94
	0.20	0.25	0.45	0.42	93	
	1.30	1.00	2.30	2.30	100	
	3.25	1.50	4.75	4.40	94	
Nd_2O_3	0.20	0.40	0.60	0.56	93	92
	2.50	1.00	3.50	3.40	97	
	0.53	0.25	0.78	0.66	85	
	2.80	2.50	5.30	5.00	93	
Sm_2O_3	0.05	0.40	0.40	0.34	85	95
	0.30	0.50	0.80	0.72	90	
	1.20	1.00	2.20	2.20	100	
	0.98	2.50	3.48	3.60	103	
Eu_2O_3	0.03	0.25	0.28	0.22	79	93
	0.34	1.00	1.34	1.45	106	

was used as a tracer. The comparison was made between porous cation resin (home made) and Zerolit 225 cation resin, and the experimental results are given in Fig. 1. The results obtained show that the porous resin has better properties than Zerolit 225 resin in the separation of rare earth impurities from matrix yttrium.

The main spearation parameters are as follows: column length: 2 X 50 cm; resin size: ~200 mesh; concentration of the eluent (α-HIBA): 0.15 *M* (pH 5.4) for Y, 0.5 *M* (pH 5.4) for La, Ce, Pr, Nd, Sm, Eu.

Under these conditions the rare earth impurities (La–Eu) can be completly separated from matrix yttrium, the matrix residue amount is less than 100 μg for 1 g of Y_2O_3 on the column. Typical results are shown in Fig. 2.

Spectroscopic Determination. The solution dry-residue method with high absolute sensitivity was adopted to analyze the concentrate of rare earths. The detailed studies on carrier influence, matrix effect, and controlled atmosphere ratio (Ar: O_2) were made in this paper, and the adequate conclusions are given below:

(1) The addition of alkali elements increases the line intensities of rare earths, the increasing order is Cs > Rb > K > Na;

(2) The line intensities of La, Ce, Pr, Nd, Sm and Eu are rising with the concentration of CsCl, the optimal concentration range of CsCl in solution dry-residue method is from 5 to 20 mg/ml. If its concentration is higher than 20 mg/ml, the increase of the background and the decrease of the line intensities of rare earths will be observed (Fig. 3).

(3) The influence of matrix yttrium and third elements in concentrate should be considered. The experimental results show that the permissive maximum amounts of Y_2O_3 and CaO are 6 mg/ml and 5 mg/ml respectively.

(4) Controlled atmosphere ratio of 4:1 (Ar:O_2) was employed, and the gas-chamber used is shown in Fig. 4.

Sample Analysis. Analytical results for La, Ce, Pr, Nd, Sm and Eu in high-purity Y_2O_3 are listed in Table I.

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E33

Accumulation of Transplutonium Elements in Accelerators

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E34

Uranyl Doped Glasses for Solar Concentrators

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Solar concentrators containing uranyl are presented. Various types of glasses were investigated: silicate, borate and fluorinated glasses.

The electronic and fluorescence spectra were recorded, the life-time of the excited state and some quantum yields have been measured.

The variations of the quantum yield can be related with uranium–uranium interactions. Consequently the best concentration of the uranyl depending upon the nature of the glass was evaluated.

Thus it is possible to build solar concentrators with adaptated parameters.

E35

Cyclotron Production of Gamma-Emitting Actinides, as Tracers for Metabolic and Waste Disposal Studies

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The employ of short-lived radionuclides as tracers for metallobiochemical studies in laboratory animals is well known and widely investigated [1]. Furthermore high-specific-activity 'neutron-deficient' radionuclides produced by light charged particle activation in low energy cyclotrons, are suitable tracers for more general investigations in the following fields:

1. Nuclear medicine (as radiodiagnostics)
2. Inorganic and organic chemistry