VOLATILITY OF RUTHENIUM DURING HEATING OF A RESIDUE CONTAINING CALCICUM PHOSPHATE

Z. Hölgye

Institute of Hygiene and Epidemiology,
Prague, Czechoslovakia

Received 4 January 1987, revised 23 March 1987,
Accepted 2 April 1987

By heating a residue attained by the evaporation of a solution containing calcium phosphate, ruthenium and nitric acid, ruthenium volatilizes. The amount of ruthenium volatilized /both carrier-free $^{106}\text{Ru}$ and milligram amounts of ruthenium/ depends on the composition of the solution before evaporation, on the temperature and time of residue heating. At $500 \, ^{\circ}\text{C}$ up to 90% of ruthenium can volatilize within six min.

INTRODUCTION

From literature data it can be seen that the transfer of ruthenium into the gaseous phase can be accomplished by three different methods:

1/ Oxidation of ruthenium ions in solution to $\text{RuO}_4$ by oxidizing agents$^1$.

2/ Heating of metallic ruthenium of $\text{RuO}_2$ in air or in oxygen atmosphere at high temperatures$^2$. By heating metallic ruthenium up to $1025 \, ^{\circ}\text{C}$ no loss in ruthenium was ob-
served, slight weight loss was observed between 1025 and 1400 °C and a very pronounced one between 1400 and 1515 °C. At these temperatures, ruthenium volatilizes in the forms of RuO$_4$ and RuO$_3$. Nonetheless, trace amounts of ruthenium $^{103,106}$Ru/ appeared in the gas phase during vitrification or calcination even below 1025 °C.

3/ Heating of a residue after evaporation of a solution containing soluble salts of ruthenium, sodium phosphate, nitrate and nitric acid. When heated to 500 °C, ruthenium, both in trace and milligram amounts, volatilizes quantitatively in a few minutes.

The third method of ruthenium transfer into the gas phase can be very easily effectuated. This method was proposed for the separation of ruthenium from different materials, including $^{103,106}$Ru separation from a mixture of fission products.

So far the volatility of ruthenium was studied only from residues containing sodium phosphate and nitrate. Since knowledge on the volatility of ruthenium is of great importance, especially at work with $^{103,106}$Ru /e.g. at the disposal of radioactive wastes/, our aim was to study the volatility of ruthenium also from residues containing phosphates of other elements. The aim of this work was to study the volatility of ruthenium from residue containing calcium phosphate.

EXPERIMENTAL

Ca$_3$PO$_4$ samples /in some cases also Ca(NO$_3$)$_2$/ were weighed into porcelain crucibles and dilute nitric acid was added. Ruthenium /carrier-free $^{106}$Ru in chloride form or RuCl$_3$ labelled with $^{106}$Ru/ was added to the solution and it was evaporated to dryness. The radioactivity of