STUDIES ON IRIDIUM AND PLATINUM DETERMINATION IN METALLIC RHODIUM BY NAA AND CPAA

P. ALBERT,* J. C. BAJARD,* R. DELMAS,** M. FEDOROFF***

*Centre d'Etudes et de Recherche par Irradiation, C. N. R. S.,
3A rue de la Férollerie, F. 45071 Orleans 02 (France)
**Laboratoire Pierre Sue, C. N. R. S.-C. E. A., C. E. N. Saclay, 91191 Gif-sur-Yvette (France)
***Centre d'Etudes de Chimie Métallurgique, C. N. R. S., 15 rue Georges Urbain, 94407 Vitry-sur-Seine (France)

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The determination of Ir and Pt in rhodium neutron monitors was investigated via $^{192}$Ir and $^{195}$Au after neutron activation, via $^{191}$Pt and $^{184}$Au-$^{196}$Au after proton activation. Ir was determined by instrumental NAA. A chemical separation of gold, with a yield measurement method by a radioactive tracer, was developed for platinum determination after neutron or proton irradiation.

Introduction

Rhodium metal is used for reactor neutron fluence and fluence rate measurements, primarily for neutron energies > 1.28 MeV via the reaction $^{103}$Rh($n,n'$)$^{103m}$Rh. Rhodium has the advantage that the energy dependence of the cross-section for the ($n,n'$) reaction is similar in shape to that of $^{238}$U($n,f$)f.p. The $^{103m}$Rh nuclide has a relatively short half-life (56.1 min) and rhodium monitor is suitable for very short irradiation times. The decay of $^{103m}$Rh, which is the transition of interest, results in the emission of 20 keV X-rays. Fluorescence interference by some elements like Ir, Pt, W is possible and the concentration of these elements must be as low as possible. Preliminary determinations of tungsten in rhodium have given a detection limit of 0.17 weight ppm, excluding any interference from this element.

The preparation of reference material EC-NRM 529 was carried out under an European Community program for the certification of reference materials for reactor neutron dosimetry. The work was coordinated by the Central Bureau
for Nuclear Measurements in cooperation with the Euratom Working Group on Reactor Dosimetry.

In the framework of this program, we studied the determination of iridium and platinum in rhodium by several ways of activation. First studies have been made in Pierre Sue Laboratory with the help of G. PINTE and D. PICCOT (CEA-Saclay) to look for the determination of Pt through $^{199}$Pt of 30.8 min half-life. This determination could not be performed because of the high activity of Ir. We decided to determine Pt through $^{199}$Au produced from $^{199}$Pt decay by radiochemical neutron activation analysis (R.N.A.A.). We also tried to use proton activation analysis (P.A.A.) for Pt as indicated by J.L. DEBRUN and J.N. BARRANDON. First experiments in C.E.R.L.-C.N.R.S. Orléans have shown that $^{194}$Au and $^{196}$Au, produced by (p,n) reactions from $^{194}$Pt and $^{196}$Pt, cannot be detected without radiochemical separation, because of the very high level of $^{103}$Pd activity produced by (p,n) reaction from the rhodium matrix. Therefore a radiochemical separation of $^{194}$-196Au after proton irradiation was investigated. We also studied the Ir determination through $^{191}$Pt produced from Ir by (p,n) reaction, but a chemical separation was needed. On the other hand, the determination of Ir through $^{192}$Ir seemed to be possible by instrumental neutron activation analysis (I.N.A.A.).

Several difficulties arise in the analysis of a rhodium matrix. Its high neutron capture cross-section needs a correction for flux depression. Another problem encountered in radiochemical separations, is the difficulty to put rhodium metal into solution. We chose a fused salt dissolution in KHSO$_4$, followed by the extraction of gold in ethyl-ether. In order to measure the yield of gold recovery during the separation, we added a radioactive tracer : in R.N.A.A. we used $^{194}$Au-$^{196}$Au produced by proton irradiation of platinum, in R.P.A.A. we used $^{199}$Au produced by neutron irradiation of platinum.