

# RECYCLING OF ALLOYS BASED ON REFRACTORY AND NOBLE METALS BY FLUORINATION WITH POTASSIUM TETRAFLUOROBROMATE

*The usual ways for solution of some noble metals, their alloys and materials containing platinum metals are:*

- Solution in acids and their mixtures (mostly used for Pt, Pd and their alloys);
- Electrolytic solution in acids at alternating current;
- Chlorination;
- Alloying ore agglomeration with alkalis or alkali (alkali-earth) metals peroxides



**In laboratory conditions solution of platinum metals realized in following ways [1]:**

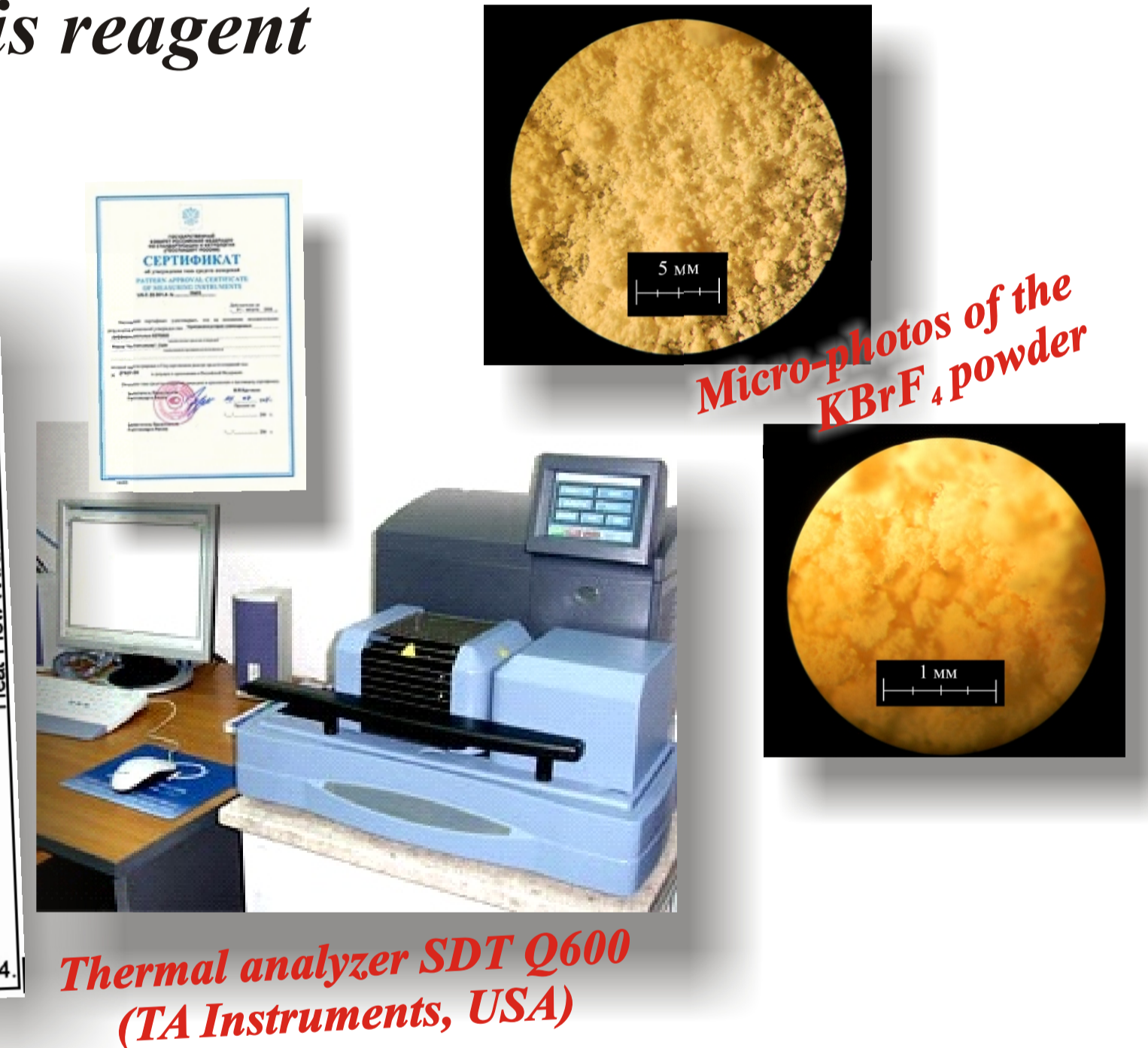
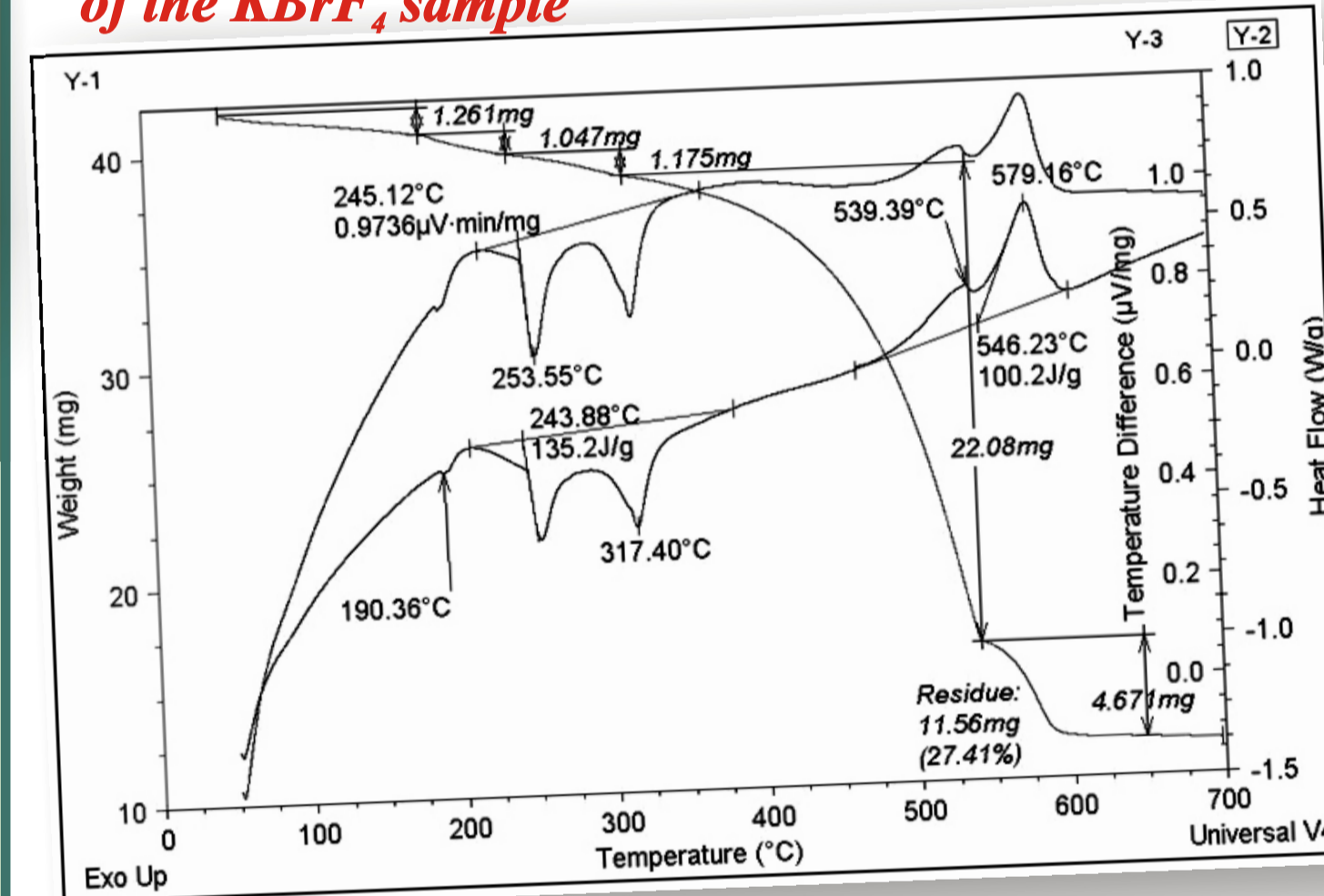
Metals	Method	Reaction equation
Ru	Alkaline oxidizing fusion	$2\text{Ru} + 6\text{NaNO}_3 + 4\text{NaOH} \xrightarrow{400^\circ\text{C}} 2\text{Na}_2\text{RuO}_4 + 6\text{NaNO}_2 + 2\text{H}_2\text{O}$
Rh	Chlorination	$2\text{Rh} + 3\text{Cl}_2 \xrightarrow{400^\circ\text{C}} 2\text{RhCl}_3$ $\text{RhCl}_3 + 3\text{NaCl} \rightarrow \text{Na}_3[\text{RhCl}_6]$
Pd	Interaction with the nitric acid Interaction with aqua regia	$\text{Pd} + 4\text{HNO}_3_{\text{конц.}} \rightarrow \text{Pd}(\text{NO}_3)_2 + \text{NO}_2\uparrow + 2\text{H}_2\text{O}$ $3\text{Pd} + 4\text{HNO}_3 + 18\text{HCl} \rightarrow 3\text{H}_2[\text{PdCl}_6] + 4\text{NO} + 8\text{H}_2\text{O}$
Os	Alkaline oxidizing fusion Oxidation	$2\text{Os} + 7\text{NaNO}_3 + 10\text{NaOH} \xrightarrow{400^\circ\text{C}} 2\text{Na}_5\text{OsO}_6 + 7\text{NaNO}_2 + 5\text{H}_2\text{O}$ $\text{Os} + 2\text{O}_2 \rightarrow \text{OsO}_4\uparrow$
Ir	Alkaline oxidizing fusion Heating with the chlorate and the hydrochloric acid	$\text{Ir} + 2\text{BaO}_2 \xrightarrow{800^\circ\text{C}} \text{BaIrO}_3 + \text{BaO}$ $\text{BaIrO}_3 + 8\text{HCl} \xrightarrow{t} \text{H}_2[\text{IrCl}_6] + \text{BaCl}_2 + 3\text{H}_2\text{O}$ $3\text{Ir} + 2\text{NaClO}_3 + 16\text{HCl} \xrightarrow{150^\circ\text{C}} 2\text{H}_2[\text{IrCl}_6] + \text{Na}_2[\text{IrCl}_6] + 6\text{H}_2\text{O}$
Pt	Interaction with aqua regia	$3\text{Pt} + 4\text{HNO}_3 + 18\text{HCl} \rightarrow 3\text{H}_2[\text{PtCl}_6] + 4\text{NO}\uparrow + 8\text{H}_2\text{O}$

## Application of oxidative fluorination technique

*Potassium tetrafluorobromate (KBrF<sub>4</sub>) is considered as the most perspective reagent for oxidative fluorination. Relatively low pressure in reaction process and liquid station of reaction mass at temperature over then 330 °C are the main advantages of this reagent*



*Thermal analytical data of the KBrF<sub>4</sub> sample*



## Reactions KBrF<sub>4</sub> with platinum metals [2]

