

PLATINUM SOLVENT EXTRACTION FROM RHODIUM-ACID SOLUTION

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ABSTRACT

Main source for platinum metals winning are spent automotive and catalyst from chemical industry, filter stuff, furnace lining from glass fibres production. All of those materials have a low content of platinum metals (mostly Pt, Pl, Rh etc.) and according to this, their processing is carried on in a several phases:

1. *previous material preparation*
2. *Smelting process to accomplish cupellation of platinum metals in copper and pouring of anodes with increased content of platinum metals*
3. *Electrolysis of anodic copper with increased content of platinum metals*
4. *Anode slime processing due to separation and refirement of platinum metals (PGMs)*

Platinum and palladium are winning by well known chemical methodes of refirement and their quality is in accordance with required ISTM Standard quality.

Rhodium of high purity (99,95%) required by ISTM Standard is almost impossible to get using only chemical methodes of refirement but if it has been got on that way the utilization is under 50%. Due to this, the methodes of solvent extraction of platinum from rhodium acid solution is worked out to get rhodium with platinum concentration of 200ppm (as it is allowed by ISTM Standard for quality of 99,95%Rh), by reduction of rhodium acid solution.

Keywords: rhodium, solvent extraction, recycling

1. INTRODUCTION

Automotive catalysts have been extensively used for reducing the emission of toxic gases from exhaust gases of automobiles. As the conditions of automobile work aren't perfect and constant (fuel quality, great number of drive motor starts up, incorrect adjusted motor operation...), it comes to reducing of catalysts function by time and it causes the need for their replacement[1]. Spent automotive catalyst contain from 0,1 to 0,3% of platinum metals. During catalyst and filter stuff exploitation in chemical industry it comes to their wearing and appears a need for their replacement too.

Furnaces for glass fibres production have inserted nozzles made of platinum metals alloys which have been spent and diffused into furnace lining by the time. Furnace lining after its replacement goes to processing for platinum metals recovering.

Already mentioned materials first go to preparation and then to processing which consist of several phases, as it was said in abstract. Automotive catalysts can be processed by hydrometallurgical treatment only [1].

After platinum metals concentration in anodic or cementation slime (if hydrometallurgical treatment is done), refinement process follows due to separation of platinum, rhodium and palladium and winning of pure metals of commercial quality.

Platinum and palladium are got by chemical methods but always remain some quantity of those metals in rhodium acid solution. It is very difficult to remove them by chemical methods and rhodium utilization is under 50%.

Total quantity of platinum (detection limit for AAS is $<0,001\text{gPt/dm}^3$), can be extracted by solvent extraction from rhodium acid solution[2,3,4,5,6,7] using tributyl phosphate solution in petroleum ether. Figure 1 shows diagrams of extraction of platinum group of metals in organic extraction agent (TBP:PE=1:3)

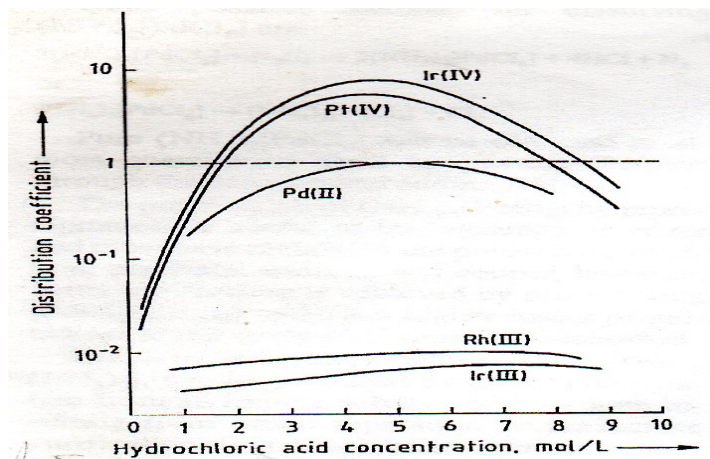


Figure 1. Coefficient of distribution of In(III), Rh (III), Pd(II), Pt(IV) and In(IV) vs hydrochloric acid concentration

2. EXPERIMENTAL

Laboratory experimental research of solvent extraction of platinum was carried out. Extraction was done from rhodium acid solution with concentration of 14,29g/l Rh and 0,88g/l Pt.

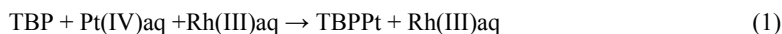
Extraction was carried out by organic extraction agent TBP diluted in petroleum ether, ratio 1:3[2,3]

Definition of platinum extraction conditions are based on diagrams showed on fig.1.

Concentration of extracted platinum by solvent extraction from rhodium acid solution was Pt $<0,001\text{g/l}$ (detection limit for AAS is $<0,001\text{gPt/dm}^3$).

3. RESULTS AND DISCUSSION

Concentration of free hydrochloric acid in rhodium acid solution during platinum extraction by organic extraction agent (TBP+PE), was 4-6M. Extraction was carried out by following mechanism:



Stripping of platinum from organic extraction agent (TBP+PE) was carried out by distilled water which enable regeneration of extraction agent and its preparation for next platinum extraction at the same time.

It is important to say that during platinum (IV) extraction by tributyl phosphate, at the same concentration of hydrochloric acid, extraction of palladium (II) goes too. As it can be seen at fig.1 the quantity of extracted palladium is minor compared with extracted platinum.

Platinum obtained by stripping from organic phase goes to cementacion with aluminium [1] and further to refinement process to platinum of commercial quality.

Based on laboratory experimental research defined parameters of solvent extraction are:

- Concentrations of free hydrochloric acid in rhodium acid 4 -6M
- Ratio of water and organic phase min1:1
- Agent for reextraction of Pt from organic phase distilled water
- Substance for cementation of Pt Al powder
- Time of one Pt extraction duration max 5 min.
- Time of one Pt stripping duration max 2 min.
- Detection limit of Pt in rhodium acid solution <0,001g/dm³

4. CONCLUSION

Total platinum removing could be accomplished by process of solvent extraction using (TBP+PE) as extraction agent. That way the quality and purity of rhodium could be 99,95%.

Platinum metals losses during extraction are minimal (<1%).

Extraction agent (TBP+PE) is possible to use many times only it has to be regenerated after each platinum extraction.

5. REFERENCES

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