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Sorption recovery of platinum metals from compound solutions

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Abstract

The research of platinum metal recovery from compound solutions including process ones with high salt content in non-ferrous and other metals is given. Effective conditions for platinum metal sorption recovery from sulphate cupronickel solutions by nitrating and anodizing methods are stated. The level of platinum family recovery is 95-99%.

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Keywords: platinum metals; sorption; ion exchange resins; process solutions.

1. Introduction

Recently special attention has been given to search of new effective methods to recover platinum metals (PM) from different raw materials: placer platinum, metallurgy platinum concentrates, dead automobile and chemical catalysts, PM scrap, etc. [1,2] Due to this new technological schemes are being developed and new affinaging factories are being established. PM transfer into solution received by metal leaching from secondary raw materials with their further concentrating and isolating is of great interest [1-3]. Sorption with new sorbents that allow PM deep concentrating and their separation from other metals is one of the efficient methods to recover and isolate PMs from compound solutions with other metals.

Nowadays the nitrogen sorbents having high absorption ability and good kinetic properties are the most advanced ones to recover PMs from solutions. These allow recovering even trace amounts of PMs from compound solutions including process ones with high salt content of non-ferrous and other metals.

The aim is to define terms for efficient PM sorption recovering from MMC "Norilsk Nickel" sulphate cupronickel solutions by Rossion ion exchange resins.

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2. Study subject

Rossion ion exchange resins, consisting of nitrogen functional groups (Table 1.) have been chosen for research as the most advanced ones to recover PM from sulphate-chloride solutions.

Table 1. Characteristics of studied ion exchange resins.

Ion exchange resin	Type	Copolymer	Physical structure	Functional groups	Exchange capacity in the Cl^- -form, mmol/g
Rossion-1p	strong base anion exchanger	SDVB	Macroporous	BMAG	3.0
Rossion-5	strong base anion exchanger	SDVB	Gel	BMAG	2.8
Rossion-10	weak-base anion exchanger	SDVB	Macroporous	PSTAG	4.4

Note: SDVB - polystyrene-co-divinyl benzene, BMAG - benzyltrimethylammonium groups, PSTAG - primary, secondary, tertiary amino groups.

3. Initial solutions and experimental method

To study PM recovering from MMC "Norilsk Nickel" sulphate cupronickel solutions by Rossion ion exchange resins three metallurgy shop solutions were chosen.

Solution after precious metal (Pr.M) additional deposition is one that is subject to Pr.M additional deposition by copper sludge at 80˚C before moving to copper electrolysis shop.

Solution after The Gulidov Krasnoyarsk Non-Ferrous Metals Plant ("Krastsvetmet") waste leaching is received by water repulping hydroxydes and "Krastsvetmet" electrical filter dust that are leached in sulphuric acid solution.

Anodic dissolution tank solution is taken from electrolyzers and forwarded to neutralization.

Composition of MMC "Norilsk Nickel" metallurgy shop studied solutions is given in Table 2.

Table 2. Content of studied solutions.

Solution type	Metal concentration, g/m^3						
	Cu	Ni	Pt	Pd	Rh	Ru	Ir
Solution after additional deposition	35.1	18.4	0.017	0.083	1.89	3.1	1.94
Solution after waste leaching	17.4	2.26	0.016	0.06	2.34	4.9	2.03
Anodic dissolution tank solution	0.01	95.9	1.28	0.32	1.54	7.92	96.0

For efficient platinum metal sorption recovery from these solutions the following methods were tested:

1. *Adding sodium chloride to PM sulphate solutions.* Sodium chloride was added to solutions until their concentration 20 g/dm^3 at temperature range from 25˚C to 90˚C during 4 hours and constant stirring.
2. *Pre-chlorination of PM sulphate solutions.* The solutions were chloridized by injecting sodium chloride (20 g/dm^3) and flowing through solution with gaseous chlorine during 30 min. till oxidation-reduction at 25˚C during 4 hours and constant stirring.
3. *Nitriding PM sulphate solutions.* Solution nitrating was made by injecting sodium chloride (20 g/dm^3) and sodium nitrite (20 g/dm^3) with resins during 4 hour constant stirring.
4. *Anodic oxidation in electrolyzers with inert anodes.* Anodic oxidation was effected by injecting sodium chloride (20 g/dm^3), 5 A current was applied on 0.2 dm^3 electrolyzer with titanium cathode and porous