New Environmentally Sound Recovery Process of Precious Metals Using Reactive Metal and Chloride Vapor Treatment

New hydrometallurgical recovery process of precious metals

Comparison between conventional process and new process

(a) Conventional leaching process
   Chemical potential of chlorine or oxygen
   \( \frac{P_{\text{O}_2}}{P_{\text{O}_3}} \)

   Oxidation → dissolution
   \( \text{PtCl}_4^{2-} \)

   Long processing time and considerable amount of acids with strong oxidants are required.

(b) Reactive metal treatment followed by chlorination or oxidation
   \( \frac{P_{\text{O}_2}}{P_{\text{O}_3}} \)

   Chlorination or oxidation prior to dissolution (\( \frac{\text{lower amount of acids used for dissolution}}{\text{higher dissolution efficiency}} \))
   \( \text{RPI}_{\text{Cl}_2}, \text{RP}_{\text{I}}\text{O}_2 \)

   Oxidation → dissolution
   \( \text{PtCl}_4^{2-} \)

   High efficient dissolution

   Compound formation under reduced atmosphere
   (pretreatment for selective and efficient dissolution)

New recovery process for precious metals using reactive metal and chloride vapor treatment

Scrap containing precious metal (M)
   \( (\text{M} = \text{Pt, Rh, etc.)} \)

   \( \text{Mg-Pt, Mg-Rh, etc.)} \)

   

- Alloy formation
- \( \text{R-Pt} \)
- \( \text{R-Pt} \)

Chlorination of R-M compounds

Minimizing amount of toxic waste solution
Utilizing chloride wastes

Synthesis of R-M compounds

Selective and high-speed dissolution

- TIG welding
- Stainless steel reaction vessel
- Stainless steel cover
- Precious metal (Mg)
- Reactive metal (Pt, Rh)
- Ta crucible
- Stainless steel crucible

Chlorination of R-M compounds

- FeCl_3
- Quartz crucible
- Stainless steel reaction vessel
- Stainless steel crucible

Results

- Dissolved in aqueous HCl solution
- Dissolved in aqua regia (HCl+HNO_3)
- Not dissolved after leaching

Dissolution efficiencies in aqua regia after alloy formation and chlorination were significantly enhanced.

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