

A Classification of Hydrometallurgy

General Process Area

1. Hydrometallurgy – Mineral Processing Interface

2. Leaching

3. Solid/Liquid Separation

4. Separation & Purification

Topics / Operations Within Process Area

1. Hydrometallurgy – Mineral Processing Interface

- 1.1 Simultaneous milling and leaching
- 1.2 Flotation
 - 1.2.1 Flotation of organic impurities
 - 1.2.2 Flotation of leach residues
 - 1.2.3 Ionic flotation

2. Leaching Processes

- 2.1 Pre-treatment (incl roasting)
- 2.2 Oxidative leaching (incl ferric)
- 2.3 Acid leaching
- 2.4 Alkaline leaching
- 2.5 Metathetic leaching
- 2.6 Irrigation leach processes (heap, dump)
- 2.7 Bacterial leach processes

3. Solid/Liquid Separation Processes

- 3.1 Filtration (incl micro- and nano-filtration)
- 3.2 Thickening & clarification (incl coagulation, flocculation)
- 3.3 Counter-current decantation
- 3.4 Other equipment (centrifuges, hydrocyclones, ...)
- 3.5 Slurry transport & pastes

4.1 Precipitation of Impurities

- 4.1.1 pH-controlled precipitation
- 4.1.2 hydrothermal precipitation
- 4.1.3 crystallisation (incl scale formation)
- 4.1.4 cementation and related reactions
- 4.1.5 electrolytic processes for impurity control

4.2 Solvent Extraction

- 4.2.1 SX process development (incl liquid membranes)
- 4.2.2 SX equipment development
- 4.2.3 Reagent development (incl diluent effects, regeneration of extractant)

4.3 Adsorption & Ion Exchange

- 4.3.1 activated carbon processes
- 4.3.2 IX process development (incl resin-in-pulp)
- 4.3.3 IX equipment development
- 4.3.4 Reagent development (incl molecular recognition)

4.4 Membrane Processes

- 4.4.1 Reverse osmosis
- 4.4.2 Ultrafiltration
- 4.4.3 Electro-dialysis

4.5 Chemical Reactions

- 4.5.1 Oxydrolisis

5. Metal Recovery

- 5.1 Electrowinning/Refining Processes**
 - 5.1.1 electrolytic process development
 - 5.1.2 electro-refining processes (incl anode treatment, by-product recovery)
 - 5.1.3 EW process optimisation (incl non-aqueous electrolytes)
 - 5.1.4 EW equipment development
- 5.2 Chemical Reduction Processes**
 - 5.2.1 pressure reduction
 - 5.2.2 other chemical reduction processes
- 5.3 Precipitation/Crystallisation of Final Products**
 - 5.3.1 crystallisation by cooling

6. Environmental Issues

- 6.1 Recycling**
 - 6.1.1 process water
 - 6.1.2 reagents (incl recovery, destruction)
 - 6.1.3 gases (incl lime boil for ammonia)
- 6.2 Emission, Effluent & Waste**
 - 6.2.1 composition & origin within process
 - 6.2.2 gaseous emissions
 - 6.2.3 suspended solids
 - 6.2.4 dissolved impurities
 - 6.2.5 chemical stability of residues
- 6.3 Acid Mine Drainage & Abandoned Mine Sites**

7. Whole-of-Flowsheet Issues

- 7.1 Process Mineralogy**
 - 7.1.1 characterisation of feed, products & emissions
 - 7.1.2 characterisation of particles
- 7.2 Process Modelling & Control**
 - 7.2.1 fundamental thermodynamics, kinetics
 - 7.2.2 simulating unit operations (incl reactor engineering)
 - 7.2.3 simulating flowsheets
 - 7.2.4 control of unit operations
- 7.3 Engineering Issues**
 - 7.3.1 heat transfer, heat exchange, heat recovery
 - 7.3.2 oxygen mass transfer
 - 7.3.3 corrosion issues & materials selection
 - 7.3.4 continuous pilot plant trials & scale-up issues

