

# COMPANY PROFILE

Jiangsu Haipu Functional Materials Co., Ltd. is a national high-tech enterprise that provides separation and purification related new materials and intelligent equipment for hydrometallurgy, energy metals, nuclear industry, resources and environmental protection, medical health and other fields. With deep technical accumulation and strong innovation capabilities, the company has mastered many key core technologies and launched a series of products and solutions with independent intellectual property rights for metal extraction and recycling, green development of the nuclear industry, hydrometallurgy, resources and environmental protection, natural product extraction, drug separation and purification and other scenarios to meet the diverse needs of different customer groups.

Haipu adheres to the original intention of "driving new quality productivity with material innovation", solves technical problems from the source and bottom innovation, and closely follows market demand, closely serves customers, continuously optimizes and upgrades, and helps customers control costs, improve quality and efficiency.



## 70%

Our R&D staff accounts for more than 70% of our staff.

## 65%

Master's degree and above More than 65%

## 100+

Domestic and foreign core patents More than 100

## HAIPU SERVICE MINERAL RESOURCES DEVELOPMENT TOTAL PROCESS SOLUTION-SEPARATION AND PURIFICATION TECHNOLOGY

Introduction

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With special adsorption technology and membrane separation technology as the core, HIPP provides customized solutions covering the whole process of 'mining beneficiation - smelting - refining and purification' for mineral development enterprises.

In the mining stage, copper, lead, zinc and other heavy metal ions in tailings wastewater are recovered through selective adsorption, realizing the resource recycling and reuse.

In the ore dressing stage, the yellow drug series of trapping agent significantly improves the flotation efficiency;

In the smelting stage, the self-developed resin products can realize the precise enrichment and separation of strategic metals such as uranium, gold, lithium, cobalt, nickel, etc. We provide customized resins for the scenarios of tungsten and molybdenum separation, nickel and cobalt salt decontamination, etc., so as to optimize the purity of the metal and the recovery rate;

In the refining and purification process, the deep purification technology removes boron, arsenic, calcium and magnesium impurities in the leachate with high precision, and efficiently recovers rhenium, gallium, vanadium and other precious and rare metals in the smelting wastewater, forming a closed loop of "resource-product-renewable resource".

### General steps of hydrometallurgy

Introduction

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#### MINING, BENEFICIATION

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##### Comprehensive utilization of tailings:

Tailings resource recovery in mining is the process of extracting and utilizing valuable resources (such as metal ions, minerals, etc.) remaining in the tailings after beneficiation by technical means; HIPP's special adsorbent resin can selectively adsorb heavy metal ions, such as copper and cadmium, in tailings wastewater, realizing the recovery of low-concentration resource enrichment and wastewater purification, and assisting in the tailings resource recycling and green development.

##### Xanthate:

As the core recovery agent for sulfide ore flotation, it enhances the surface hydrophobicity of copper, lead, zinc and other sulfide ores through selective adsorption, and accurately recovers the target minerals and separates them from the vein stones in the flotation process, which can significantly improve the metal recovery rate. With the optimized formula, HIPP's self-researched yellow agent can adapt to the complex slurry environment to reduce the loss of chemicals and the cost of sorting.

#### SMELT METAL

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##### Pyrometallurgy:

Flue Gas Resource Recovery, Rhenium Extraction from Dirty Acid

##### Hydrometallurgy:

Through special resin and membrane technology, selective adsorption realizes efficient extraction and separation of metals, and its core applications include:

**Metal enrichment and purification:** adsorption of metal ions such as copper, nickel, cobalt, etc., enrichment of precious metals (e.g., gold, silver) and rare metals (e.g., vanadium, molybdenum) in the low-concentration solution, and obtaining high-purity metals through desorption.

**Impurity Separation:** Remove salts, heavy metal impurities (e.g. lead, mercury) and radioactive elements from the solution to enhance the purity of metal products.

**Wastewater treatment:** adsorption of heavy metal ions (e.g. chromium, mercury) and adjustment of pH, reducing pollution, resin can be regenerated and recycled.

#### REFINING AND PURIFICATION

3

##### Removal of impurity metals in electrolyte

Application: In copper, zinc, nickel and other electrolyte purification, the resin can selectively adsorb bismuth, antimony, chlorine and other impurity ions.

##### Precious metal and rare metal extraction

Precious metal recovery: for gold, silver, platinum and other precious metals adsorption recovery

Rare earth metal purification: deep removal of iron, zirconium, titanium and other impurities from scandium chloride solution.

## Comprehensive utilization of tailings

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Separation and recovery of cobalt and copper from low di concentration copper and cobalt tailings:

Copper and cobalt mine tailings, the use of special chelating resin can be separated from the low concentration of tailings water recovery of cobalt and copper, the separation effect is good, the metal yield is high, the operating environment is better, less environmental pollution, easy to operate, easy to realize mechanization, automation, low processing costs, while the product quality is excellent.

Gold tailings recovery: combined with re-election and cyanide leaching process, special adsorption resin enrichment of gold elements, elution or incineration recovery of gold; the recovery of other associated elements (copper, lead, zinc), to further improve the efficiency of flotation and cyanide separation, improve the efficiency and quality of copper, zinc and other extraction.

Comprehensive utilization of copper tailings: In addition to copper tailings containing incompletely extracted copper resources, they also contain other associated elements, such as sulfur, iron, zinc, lead, gold, silver and so on. The valuable resources can be recovered twice through re-election, and the specialized adsorption technology can selectively recover the copper, gold and other metal elements.

Comprehensive utilization of other metal tailings: For the comprehensive recovery of iron, manganese, tungsten, molybdenum and other tailings, special resin can be used to separate and enrich the main elements and associated elements.

## Xanthate:

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Isobutyl sodium xanthate (potassium): strong capture, suitable for copper, lead, zinc sulfide ore (chalcopyrite, sphalerite, pyrite) flotation.

Sodium butylxanthate (potassium): strong mixed flotation capacity, can give priority to the selection of copper sulfide ore, activated sphalerite sorting.

Sodium (potassium) isopropylxanthate: stronger trapping power, can also be used as precipitant for hydrometallurgy, rubber vulcanization promoter.

Sodium (potassium) ethylxanthate: optimal selectivity, suitable for easy to float/complex sulfide ore preferential flotation, can be used in conjunction with sulfiding agent flotation of copper-lead oxide ores, also used as a precipitant for hydrometallurgy and rubber vulcanization accelerator.

## Smelting, refining and purification

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Copper, Nickel, Cobalt, Manganese Liquid Purification and Valuable Metal Recovery

Lithium extraction from salt lake and recovery of associated resources such as potassium, boron, magnesium, etc.

Extraction and purification of gallium, vanadium, molybdenum and other mineral metals

Enrichment and purification of rare earth elements such as scandium and lutetium

Enrichment of gold, silver, rhodium, germanium, rhenium and other valuable metals

Flue gas recovery of rare elements, rhenium extraction from dirty acid, smelting slag metal extraction, high temperature flue gas purification

# HAIPU APPLICATION SCENARIOS

Areas of application		Product Model	Typical Application Scenarios	
Special collector for sulfide ore flotation		Sodium (potassium) isobutylxanthate	Copper-Lead-Zinc Sulfide Ore Capture	
		Sodium (potassium) butylxanthate	Preferential flotation of copper sulphide ores, activation of sphalerites	
		Sodium (potassium) isopropylxanthate	capture of sulphide minerals, precipitation of uranium/gold ions	
		Sodium (potassium) ethylxanthate	Preferential flotation of easy-to-float/complex non-ferrous sulfide ores, copper-lead oxide ores, precipitation of metal ions	
Mineral metal extraction and purification	Absorbent	HP686	Extraction of copper and nickel	
		HPC001	Cobalt extraction	
		HP4900	Nickel Sulfate Silicon Removal	
		HP115	Rhenium extraction	
		HPB119	Boron removal	
		HP892	Gallium extraction from Bayer's mother liquor alkali	
		HPG3	Gallium extraction from Bayer's masterbatch acid	
		HP5118	Gallium extraction from acidic materials	
		KF380 KF420 KF340	Strongly alkaline anion resin	Uranium Extraction Precious Metals Recovery Rare Earth Element Separation Heavy Metal Removal
		HP1048 HP1053 HP1042	Weakly Alkaline Anion Resin	Selective vanadium extraction Molybdenum, tungsten extraction Acid wastewater treatment
		HP409		Germanium extraction
		HP4080		Gold, silver, platinum, palladium and other precious metals extraction
		HP560		Removing antimony and arsenic from leaching tail liquid
		HP4010		Calcium and magnesium removal from lithium sulfate feed solution
		HP708		Cadmium removal
		HP706		Deep heavy metal removal
		HP3500		Remove fluorine
		HP5600		Phosphorus removal from lithium iron phosphate feed solution
		HP606		Lithium Iron Phosphate Aluminum Removal
		HP268		TOC removal
HP165		Salt lake brine (aluminum)		
HP910		Salt lake brine/lithium precipitation mother liquor (titanium system)		
HPY408		Extraction of rubidium and cesium		
Salt concentration and acid-base preparation		Bipolar membrane electro dialysis equipment	Conversion and recycling of inorganic salts, preparation of organic acid salts and organic alkali salts	

# HAIPU -MINERAL RESOURCES DEVELOPMENT PROCESS APPLICATION SCENARIOS

Introduction

## Extraction of nickel from laterite nickel ore



Among the laterite nickel ores, the limonite layer is the most suitable for nickel resource extraction by hydrometallurgical process, and its composition is characterized by high iron content, high cobalt content, and low nickel-magnesium-silicon content. The quality concentration of nickel metal in the acid leach solution is low and the composition is complex, so the enrichment of low concentration of nickel and the separation of other metal impurities have become the key to the wet extraction process of limonitic nickel laterite ore. Special adsorbent materials can selectively enrich and separate nickel ions to realize the efficient extraction of low-grade nickel ore.

## Enrichment of copper by adsorbent



The hydrometallurgy of copper mining usually adopts the process of burning+acid leaching+extraction+electrowinning, and the tailings water and raffinate still contain considerable copper ions. The special adsorption method can selectively recover low-concentration copper ions from such waste liquid, concentrate them to more than 3%, and reuse them in electrowinning to obtain high-quality cathode copper.

Introduction

## Comprehensive utilization and treatment of waste acid from pyrometallurgical copper smelting (rhenium extraction, arsenic removal, fluorine removal and cadmium removal)



During the copper smelting process, rhenium is accompanied by high-temperature flue gas and washed by dynamic waves, and is present in the waste acid in the form of rhenium acid. A special adsorbent can be used to adsorb rhenium in waste acid, and rhenium-rich liquid can be obtained through elution, and then the target rhenium product can be obtained through a series of separation and purification methods. In addition, waste acid is rich in arsenic, cadmium, lead and other pollutant elements. In industry, sulfide precipitation method is often used for efficient separation and treatment. However, the treatment accuracy may often cause pollutants to exceed the standard due to differences in management levels. Combined with special adsorbent deep treatment, it can stabilize the treatment accuracy and further reduces pollutant emission standard. Excessive fluoride ions after the reused waste acid are also a major treatment problem. The sulfide precipitation method cannot effectively remove fluoride ions, while the lime method could produce a large amount of sludge and has low treatment accuracy. Special fluoride removal adsorbent is can be used to significantly reduce the consumption of lime and defluoridation agent, and reduce the output of solid waste.

Introduction

## Deep heavy metals removal, arsenic removal, fluorine removal, etc. from mine wastewater

Mine wastewater contains a large amount of heavy metals, and the acidity or alkalinity is strong. If discharged at will, it will cause irreversible effects on the surrounding environment and human health. Regarding the traditional physical and chemical treatment technology, the treatment accuracy is difficult to guarantee, and the operating cost and chemical consumption are relatively high. Haipu's special adsorbents for heavy metal removal, arsenic removal and fluorine removal, which is widely used in standard treatment and discharge sections and reclaimed water reuse sections, can selectively remove typical pollutants in mine wastewater, improve treatment accuracy and significantly reduce chemical consumption.



Introduction

## Extraction of molybdenum from molybdic acid leaching solution by adsorbent

The molybdenum-containing leaching solution is obtained by oxidation and acid leaching of high-temperature alloy waste. Molybdenum is selectively extracted from the molybdenum-containing acid leaching solution by adsorption method. The PH of the molybdenum-containing acid leaching solution can be adjusted with sodium carbonate solution first, and molybdenum is adsorbed from the molybdenum-containing acid leaching solution by a special resin. Then, the molybdenum is desorbed by the mixed solution of ammonia water and ammonium chloride. The obtained ammonium molybdate solution is evaporated and concentrated, and then cooled and crystallized to obtain white ammonium molybdate crystals, so that the molybdenum in the acid leaching solution can be effectively recovered.



Introduction

## Extraction of gallium from Bayer process solution by adsorbent



Gallium is extracted from the Bayer process solution by ion exchange. After the resin is saturated with gallium, it is eluted with a special alkaline complexing eluting agent. The qualified eluted solution is treated by evaporation concentration, freezing crystallization, oxidation and other processes before electrolysis to obtain the gallium product. The resin after desorption and regeneration can be returned to the adsorption process for reuse after transformation. The process is simple, the product cost is low, and it does not pollute the environment. The gallium adsorption rate can reach 60% to 65%, and the electrolysis recovery rate is greater than 90%.

Introduction

## Enrichment of gold and silver by adsorbent



In the cyaniding smelting of gold and silver, special resins are used to extract the gold and silver dissolved in the cyanide leaching ore pulp or cyanide leaching solution through ion exchange reaction, and the gold and silver in the form of cyanide complexation anions are adsorbed on the resin. The gold and silver can be selectively recovered through special eluting agents, or they can be directly incinerated to obtain gold and silver elements.

Introduction

## Removing residual extractant

For the smelting section where extraction technology can be used, a small amount of extractant is often left in the water phase as an oil phase. The special adsorbent can deeply separate oil from water, recover the organic solvent (extractant and kerosene) lost in the water phase, desorb and extract a small amount of organic solvent.



# APPLICATION CASE

## Molybdenum extraction from Heilongjiang copper-molybdenum ore



HP1048 three-column tandem adsorption process in copper ore molybdenum extraction project shows excellent performance stability and resource efficiency: raw water molybdenum content ~ 16g / L, adsorption volume 15BV, adsorption flow rate of 0.8BV / h, adsorption of water batch stability <10mg / L, adsorption capacity of the stable batch of 240g / L or so; batch experiments on the balance of the adsorption and desorption of the material, the stability of good materials.

## A large copper company in Shandong rhenium



Rhenium in the crust of the earth's abundance is very low, and associated with other minerals, the project from the copper smelting ash and flue gas scrubbing system waste acid recovery of rhenium, through the Hai Pu Functional Materials Co., Ltd, independent research and development of high-performance adsorbent recovery of rhenium special adsorbent HP115, rhenium content of the original sewage acid in the rhenium content of 5-12 ppm, rhenium adsorbed down to less than 1 ppm, enriched to rhenium in the resin material and then through ammonia Desorption regeneration, in the form of ammonium rhenate into the desorption solution for subsequent evaporation section for rhenium resource recovery.

## Guangxi New Energy Nickel Sulfate Refining and Silicon Removal



With the continuous application of nickel salt products in lithium-ion battery cathode materials, the requirements for its impurity content are also higher and higher, new energy enterprises to produce high-quality nickel sulfate material liquid process, need to remove the impurities in it to reduce the silicon content, Improve the purity, so as to improve product competitiveness. This process resin HP4900 in addition to high selectivity of silicon, other coexisting anions interfere with small, high processing precision, good adsorption performance.

## Sichuan new energy lithium pyroxene ore lithium sulfate except calcium and magnesium



This group of companies has an annual output of 50kt lithium salt production line project. The existing stream of lithium sulfate purification liquid needs to be purified twice with ion exchange resin system. The water volume of this material liquid is about 120m<sup>3</sup>/hour, the calcium and magnesium ion content of lithium sulfate purification liquid is not up to standard, the calcium and magnesium ion content of the feed material is about 45mg/L, and it is required that the total amount of calcium and magnesium will be reduced to less than 10mg/L. After HP4010 resin adsorbs the material liquid and removes calcium and magnesium, the material liquid will return to the production line for the subsequent lithium precipitation, and the owner purchases a complete set of resin adsorption process to carry out deep decontamination treatment of the material liquid and improve the product quality. By purchasing a complete set of resin adsorption process, the owner can carry out in-depth decontamination treatment for lithium sulfate material liquid and improve

## Fujian New Energy Phosphorus Iron Ore Phosphorus Removal



A new energy enterprise in Fujian, Sichuan, lithium iron phosphate production project in the wash water needs to remove the total phosphorus, wastewater standards into the next process section. This project adopts HP5600 adsorption treatment process, the TP content of wastewater ~ 1000mg / L through adsorption to remove the TP content of the effluent ~ 2mg / L, to achieve the TP content of wastewater to meet the standards, desorption of regeneration of sodium phosphate components for recycling. It not only solves the problem of wastewater treatment but also realizes the recycling of resources. The system has a high degree of automation and does not introduce impurity ions.