



中信大锰矿业有限责任公司

DAMENG CITIC DAMENG MINING INDUSTRIES LIMITED



电解金属锰生产技术的发展方向

The Development Direction of EMM Production Technology

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1.1 生产工艺与装备技术

production technique and equipment technology

技术现状

A、以碳酸锰矿法生产为主，典型企业主要分布在重庆秀山、湖南花垣、广西大新、靖jing西、湖北长阳、贵州松桃、遵义一带。但多数企业未经选矿富集。A. Use manganese carbonate ore recovering as the main method: these enterprises are located in.... However, most enterprises of this category do not incorporate ore selection and ore enriching into their production process.

B、化合工艺部分企业实现了机械加料，典型代表为行车起吊、罐车、螺旋机加料等。（插图片）但仍有相当一部分企业采用人工投料，尤其是早期建成的小企业（规模5000吨/年以下）。As for the chemical combination process, some enterprises have adopted mechanical loading or feeding method, like using crane, tank truck and screw conveyor to load material. However, there are still some enterprises which adopt manual material loading process, especially those early founded enterprises.

1.1 现状-production technique and equipment technology

- C、固液分离工艺以隔膜压滤为主，部分企业实现了三段压滤，使溶液净化得到加强；少数企业实现了粗滤渣与硫化渣分步压滤，为有效回收重金属创造了条件；
- **membrane filter press** is the main technology in the process of solid-liquid separation. Some enterprises use pressure filter in three sections, which has enhanced the purifying of the solution. A few enterprise adopt two-step filter press of rough filtered solid waste and sulfurate solid waste separately, which creates favorable conditions for the effective recovery of heavy metal.
- 压滤设备部分企业使用了高压隔膜设备，并加装了反吹洗涤装置，使滤渣水分控制到25%以下。（插图片）但仍有相当一部分企业采用板框式压滤机，且过滤面积偏小
- As for the filter press equipment, some enterprises adopt high-pressure membrane filter machine and also installs the blowing and cleaning device, which can help to control the moisture of filtered solid waste to a level of less than 25%. However, there are still quite a few of enterprises who use plate and frame type filter press, whose filter effect is relatively weak.

1. 1现状-**production technique and equipment technology**

- D、电解工艺普通级仍以加硒电解为主，高纯级以加二氧化硫电解为主。电解装置仍以木槽衬PVC为主。绝缘性较差；且均为小槽电解。（插图片）

selenium is mainly used in the electrolyzing method for general purpose, while for high purity purpose sulfur dioxide is mainly used. And the device for electrolysis is still wooden electrolytic bath plus PVC, which is very poor in insulation. Moreover, most of the electrolyzing process is conducted in small electrolytic bath .

- E、产品后处理仍以人工操作为主，部分企业实现了机械起板。小数企业实现了机械剥板。（插图片）??

The post-treatment of product is mostly conducted by manual force, although some enterprises have make use of mechanized devices.



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1.2 环保技术

A、化合工序普遍安装了**酸雾**吸收装置，酸雾的无组织排放得到了有效控制（插图片）

As for the chemical combination process, the absorption device of acid fog is widely installed. Thus the emission of acid fog is effectively controlled.

B、含**铬**废水普遍采用**硫酸亚铁+石灰**中和法进行处理后循环使用。（插图片）

Chromium waste water is treated and recycled with the widely-adopted ferrous sulphate and lime neutralization method.

C、含**锰**废水普遍采用**石灰**中和法进行处理后循环使用。（插图片）

Manganese waste water is treated and recycled with the widely-adopted lime neutralization method.

D、部分企业安装了**Mn、Cr、PH**等离子的在线监测装置，实现了废水的动态管理。（插图片）

Some enterprises have installed the on-line monitor device of ions like Mn, Cr (chromium) and the PH value, which has fulfilled the dynamic management of waste water.

E、**锰渣**综合利用尚处于研究阶段。The comprehensive utilization of Manganese solid waste is still under research.



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2.1 生产规模和装备向大型化发展

1. Development towards large production scale and large equipments

A、单条电解锰生产线将突破3万吨（目前已达1.5万吨）
（插图片）

A. The output of a single EMM production line will exceed 30K tons (now it has reached 15K tons)

B、单个化合槽容积将突破300M³（目前已达260M³）

B. The **capacity** of a single chemical synthesis bath will exceed 300 M³. (now it has reached 260)

C、单个压滤设备过滤面积将突破1000M²（目前已达500M²）

C. The **filtering area** of a single filter press device will exceed 1000 (now it has reached 500)

D、单个电解阴、阳极板面积将突破2M²（目前为0.56M²）

D. The area of a single electrolytic cathode and anode plate will exceed 2 (now it has reached 0.56M²)

技术发展趋势

2.2 生产流程向机械化、自动化发展

development towards mechanized and automatic production process

A、化合工序机械加料将全面实现，连续浸出将得到推广应用

-----广西汇元锰业设计已采用连续浸出工艺

A. Mechanical feeding of material during the chemical synthesis process will be applied across the industry and the technique of continuous leaching will be further promoted.

B、压滤工序将实现从进浆-洗涤-排渣的机电一体化

-----国家环科院、湖北景津集团公司已研制出并开始工业化推广应用，秀山武陵锰业等已率先应用

B. The filter press process will be fully mechanized from induction, cleaning to waste disposal. – Chinese Research Academy of Environmental Sciences and Hubei Jingjin Group Co., Ltd have developed such technique and started to promote its application in the industry. And Xiushan Wulin Manganese Industrial Co., Ltd has already led the way in applying such technique.

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2、生产流程向机械化、自动化发展 development towards mechanized and automatic production process

- C、电解工序将实现从装槽-出板-洗涤-烘干-剥板的机电一体化
- -----浙江三友化工已设计出并开始工业化推广应用，湖南泸溪金旭冶金公司已率先应用

The electrolytic process will also be fully mechanized from bath loading, plate discharging, cleaning, frying to plate peeling. – Zhejiang Sanyou Chemical has developed such technique and started to promote its application in the industry. And Hunan Luxi Jinxu Metal Smelting Co., Ltd has already led the way in applying such technique.

- D、电解过程将实现自动化在线监测与调节，木制电解槽将逐步被绝缘性能好的改性聚丙烯电解槽取代，并实现大槽电解
- -----湖北长阳、宁夏天元等已率先应用，但仍为小槽电解装置

The electrolytic process will be automatically monitored and adjusted on-line. And the wooden electrolytic bath will gradually be replaced by larger polypropylene electrolytic bath with sound insulation property. - ----- Hubei Changyang, Ningxia Tianyuan, etc, have led the way in this regard, although the process is still conducted with small electrolytic bath.

3、生产工艺向多样化发展

A、碳酸锰矿法仍是电解锰生产主流

manganese carbonate ore method is still the main production method of EMM

-----碳酸锰矿分布广，储量丰富，采购加工成本低，磨成粉后可直接化合，但钙镁含量偏高，酸耗较高。

manganese carbonate ore is widely distributed with rich reserves in China, and is inexpensive for purchasing and processing. After grinding into powder, it is immediately ready for chemical combination. However, the content of Calcium & Magnesium is relatively high, and thus has a high level of acid consumption

-----40%酸耗被钙镁吸收

40% of acid consumed is absorbed by the Calcium & Magnesium

-----试验结果表明，锰品位提高2%，回收率可提高1%，矿耗减少800kg，酸耗降低400kg,锰渣减少1吨

Experiment results show that the every 2% increase in the grade of manganese ore can improve the recovery rate by 1%, reduce ore consumption by 800kg, reduce acid consumption by 400kg and solid waste by 1 ton

-----有条件的企业应开展选矿富集工作

Enterprises with the required condition should promote the efforts in ore selection and enriching

3、生产工艺向多样化发展 **diversified production technique**

B、氧化锰矿法将同时并存 **manganese oxide ore method is adopted at the same time**

-----还原技术的突破为低品位氧化锰矿的应用得到普及

Breakthrough in reduction technology promote the popularity of using low-grade manganese oxide ore.

-----回转窑、立窑焙烧技术已经成熟，但热效率偏低，焙烧成本过高，影响了其推广应用

The roasting technology of rotary kiln and vertical kiln is very mature now. However, the relatively low thermal efficiency and the high cost of roasting have adversely influenced its large-scale application.

-----微波焙烧技术的应用，解决了热效率偏低问题，现已研制出工业样机，有望取代回转窑焙烧工艺

The use of oven roasting technology has solved the problem of relatively low thermal efficiency. Now the model device for industrial application has been developed, which is expected to replace the current rotary kiln roasting technique.

-----利用制糖废液做还原剂的试验研究已进入工业试验阶段，该还原工艺的成功应用，节省了焙烧成本，将与碳酸锰矿法生产成本基本持平

The research of using the waste water from sugar production as the reductant has entered the stage of industrial experiment. The successful application of such reducing technique will save the cost for roasting and will be the same in terms of cost as the Manganese Carbonate Ore method.

-----两矿一步法在个别企业有过应用，但产品质量不稳定（S超标），影响其推广应用 **The two ore in one step method has been adopted by a few enterprises. But the quality of the product is not stable (the content of selenium is out of limits), which has prevented the production method from being widely adopted.**

3、生产工艺向多样化发展 **diversified production technique**

C、无铬钝化工艺将得到推广应用

-----一些企业已开始应用，只要对无铬钝化剂加以改进，延长产品保存期，无铬钝化工艺将得到推广应用

Chromium-free inactivation technique will be widely promoted. Some enterprises have started to apply such technique. So long as the Chromium-free passivator is further improved and the retention period can be prolonged, such technique will be widely promoted.

D、产品的无硒化将得到普及

-----A、B级产品已实现无硒化，但无硒电解电流效率偏低，电耗较高，影响了普及。只要对电解工艺加以优化，电流效率仍有提升的空间。

The selenium-free property of the product will be widely promoted.

A and B grade product have already become selenium-free. However, the relatively low current efficiency of the selenium-free electrolytic process and the relatively high electricity consumption have adversely influenced its wide application. Nevertheless, so long as the electrolytic technique can be further improved, the current efficiency still has room for improvement.

4、三废综合利用将有新突破

4. New breakthrough will be expected in the comprehensive utilization of the three waste- gas, water, solid.

a、气体将得到有效回收

a. Waste gas will be effectively recycled.

以广西大新下雷碳酸锰矿为例，生产1吨电解锰将产生1.2吨CO₂气体，产气点在化合工序。酸雾吸收装置已对其中的粉尘滤除，余下均为CO₂气体直接通过烟囱排空。如能加以回收，1个3万吨的电解锰厂每年就可实现3万吨的CO₂减排，利国利民。

Take the manganese carbonate ore of Guangxi Daxin Xialei Co., Ltd for example. The production of 1 ton EMM will generate 1.2 ton of carbon dioxide gas, mainly in the chemical combination process. The acid fog absorption device can filter the dust in the waste gas, and the rest is all CO₂ gas, which is directly emitted through the chimney. If the CO₂ gas can be recycled, a EMM factory with an annual output of 30K tons can realize 30K tons in CO₂ emission reduction, which will benefit both our environment and the people.

B、锰渣的全量化利用将成为可能

The full utilization of manganese solid waste can be possible

- 已有多家科研院所、大专院校对锰渣的综合利用进行广泛研究，并已试制成样品，如已试制成建材用砖、水泥辅料等； Now there are several scientific and research institute as well as institutions of higher education conducting extensive research of the comprehensive utilization of manganese solid waste. And they have also produced samples like construction bricks, cement auxiliary material, etc.
- 分步硫化后的硫化渣经过简单的酸洗、萃取，可对其中的钴、镍加以回收。仍以广西大新下雷碳酸锰矿为例，1个3万吨的电解锰厂每年可回收30吨的金属钴、镍，增加效益1500万元； The sulphated solid waste can be recycled. With simple acid pickling and extraction, the cobalt and nickle contained can be recovered. Take the manganese carbonate ore of Guangxi Daxin Xialei Co., Ltd for example. A EMM manufacturer with an annual output of 30K tons can recover 30 tons of cobalt and nickle metal, which offers an additional income of 15M RMB.
- 如再对中和除铁分步进行，可进一步回收其中的 $\text{Fe}(\text{OH})_3$ （铁红）。仍以广西大新下雷碳酸锰矿为例，1个3万吨的电解锰厂每年可回收1万吨的铁红，增加效益500万元； If further steps are taken for neutralization and ferrum/iron separation, the iron oxide red contained can be recovered. Take the manganese carbonate ore of Guangxi Daxin Xialei Co., Ltd for example. A EMM manufacturer with an annual output of 30K tons can recover 10K tons of iron oxide red, which offers an additional income of 5M RMB.



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技术
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5、清洁、节能、环保将是电解锰企业 最终追求目标

**Cleanness, energy conservation and environmental
protection will be the final goal of EMM
enterprises**



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