"Emerging techniques for prevention and control of industrial pollution"

MINISTRY OF ECOLOGY AND NATURAL RESOURCES OF THE REPUBLIC OF KAZAKHSTAN
NCJCC «INTERNATIONAL GREEN TECHNOLOGIES AND INVESTMENT PROJECTS CENTER»

Partners and international cooperation

BAT Bureau

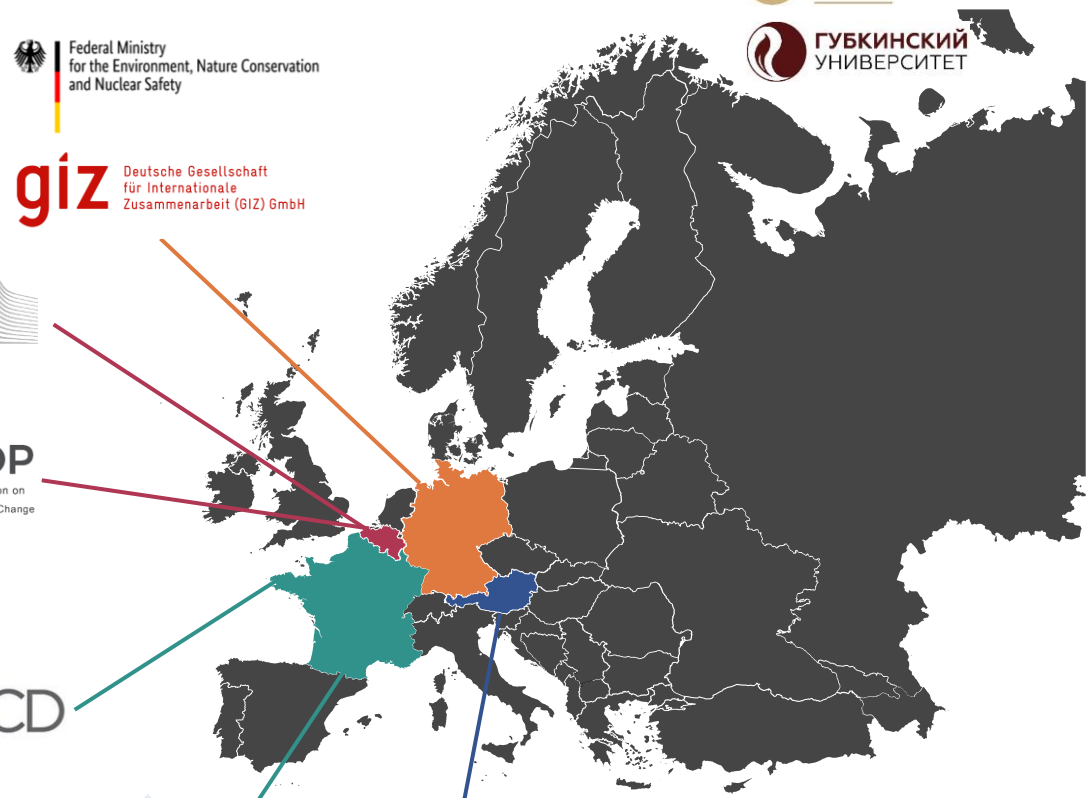
Development of a reference book on BAT
Energy Efficiency in Economic Operations and (or) other activities»

Expert sessions and exchange of experience;
Training seminars for the BAT Bureau of RK and stakeholders;
Mutual coverage of activities on official internet resources.

Consultancy support for the development of BAT reference books ;
Independent assessment of the methodology of economic evaluation of BAT;
Independent assessment of emission levels in draft BAT projects;
Conducting dispersion modelling;
Comparison of results with internationally recognised
Air quality standards (WHO, EU)

Consultancy support for the development of BAT reference books ;
Independent assessment of the methodology of economic evaluation of BAT;
Independent assessment of emission levels in draft BAT reference books ;.

Expert developers in BAT reference books ;
Independent assessment of the process of developing BAT reference books ;
Independent assessment of the legal and regulatory framework for the development of BAT reference books
Joint methodological project on the development of BAT reference books .



Aluminum industry of Kazakhstan

Kazakhstan is not among the leaders in bauxite reserves but is the ninth largest producer of bauxite in the world. Kazakhstan has a full cycle of ***primary aluminum production****, which includes* ***bauxite mines****,* ***an alumina refinery*** *and an* ***electrolysis plant.***

Aluminum production in Kazakhstan occupies a special place in the world hierarchy of alumina producers.

It produces alumina from low-quality bauxite raw materials using the world's only technological scheme - ***"Sequential-Parallel Variant Bayer- Sintering".***

The uniqueness of the Kazakhstan Aluminum Smelter is that it can only operate with the bauxite raw material available in Kazakhstan. Replacement of the raw material base is not an option.

Main technological processes

Bauxite

- Preparation of raw materials (bauxite)

Alumina

- Production of alumina by the Bayer -sintering method
- Processing of red mud from the Bayer branch

Baked anodes

Primary aluminum

- Production of baked anodes
- Primary aluminum production

Emerging techniques and technologies in aluminum production

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- *Bayer-hydrogranate technology of ferruginous bauxite processing*
- *Use of low-grade process fuel in alumina production*

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- *Inert anodes*
- *Electrolysers, 400 and 500 kA current capacity*
- *Reduction of CO emissions from electrolysis baths by applying a special protective coating to the anode against oxidation and anode burnout in the electrolyser*

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- *Hybrid bag filter (electrostatic precipitator + bag filter).*
- *Alumina production by the nepheline sintering method.*

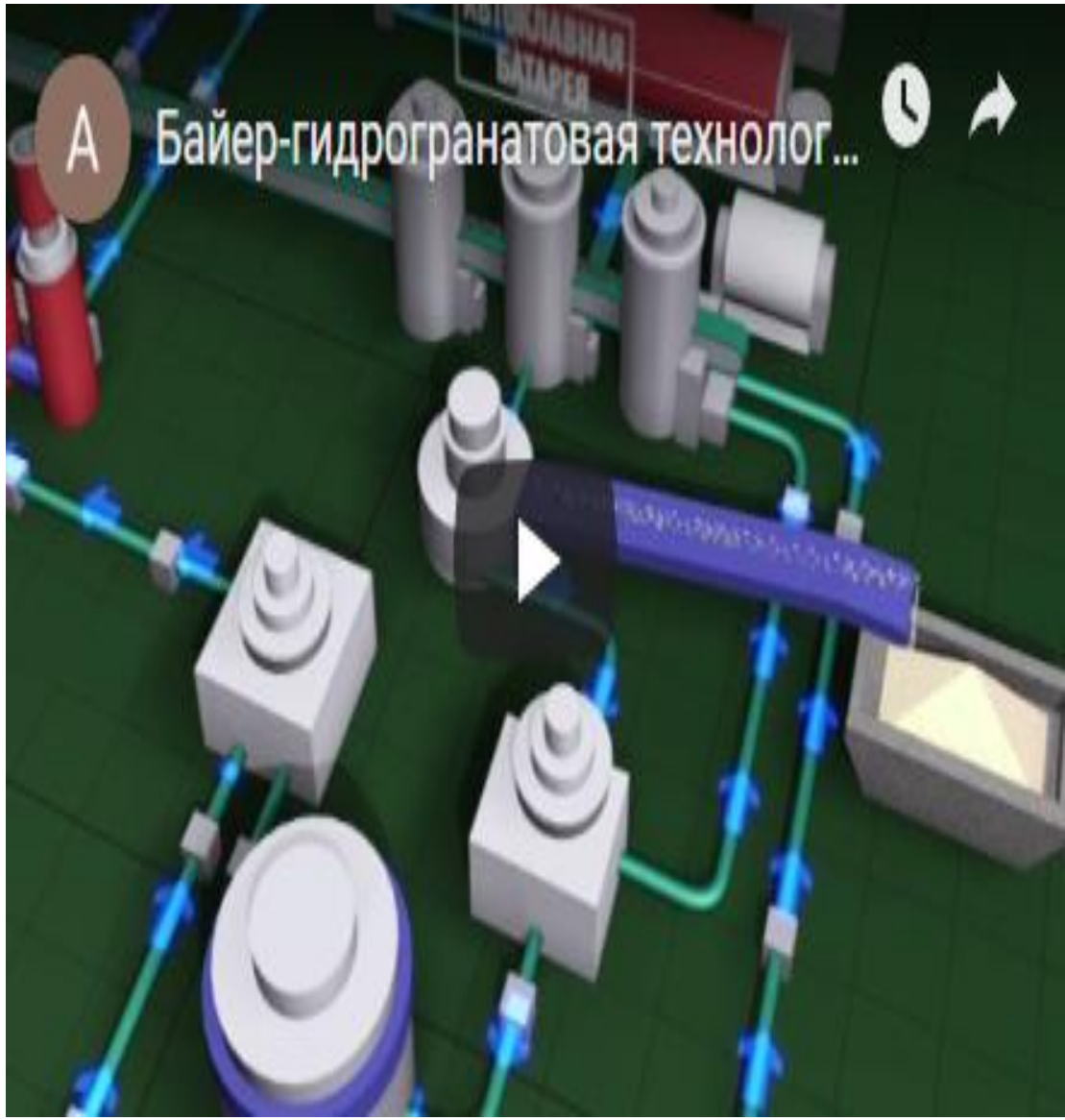
Bayer-hydrogranate technology of ferruginous bauxite processing

The new technology compared to the **Bayer - sintering** has the following advantages:

-fuel and electricity consumption is reduced by 35%

-alkaline reagent costs are reduced by 60%

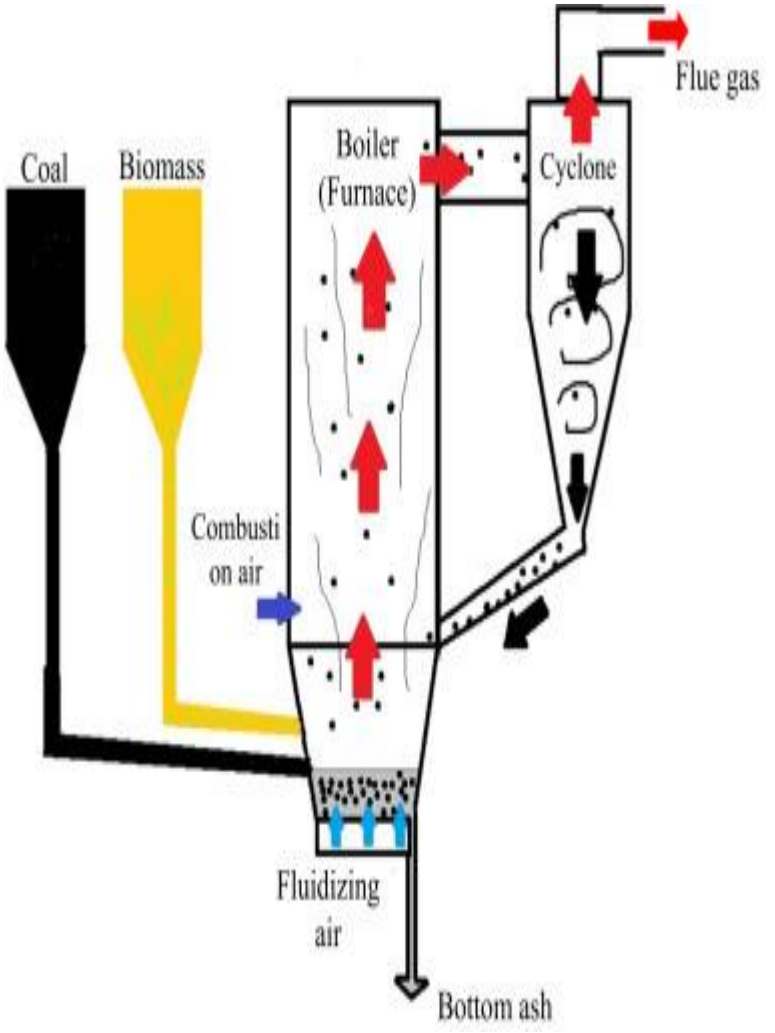
-the level of harmful emissions into the atmosphere is reduced by 2-3 times



Use of low-grade process fuel in alumina production

Installations operating on gas fuel have a higher efficiency compared to installations using other types of fuel, they are simpler and cheaper to operate, are relatively easy to automate, which increases safety and improves the technological process, and do not require complex fuel supply and ash removal devices.

The gas is burned with minimal harmful emissions, which improves sanitary conditions and the environment.



Inert anodes

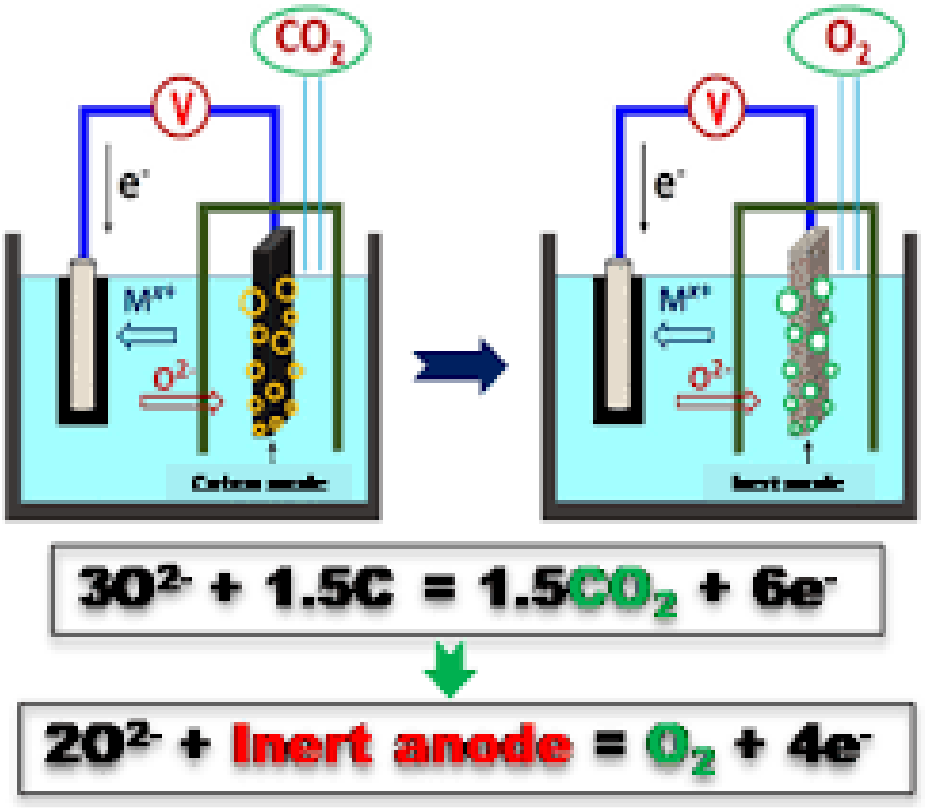
Aluminum production using an inert anode is a revolutionary technology that is unparalleled in terms of environmental effect.

The main advantages of this technology in terms of environmental protection:

-complete elimination of greenhouse gas and polyaromatic hydrocarbon emissions during aluminum production;

-reduction of production cost by more than 10 % due to saving of anodes and electricity;

-reduction of capital costs in the construction of new plants by more than 30%.



The chemical reaction of aluminum production in electrolyzers with inert anodes can be represented as follows:

$$Al_2O_3 \rightarrow 2Al + 3/2O_2$$

Electrolysers, 400 and 500 kA current capacity

The world's leading aluminum companies are seeking to operate high amperage electrolyzers, as the use of high amperage electrolyzers can improve the economic efficiency of new plants by reducing specific capital and operating costs.

Reduction of CO emissions from electrolysis baths by applying a special protective coating to the anode against oxidation and anode burnout in the electrolyser

It is common practice to coat the top of pre-baked anodes with a mixture of alumina and crushed electrolyte.

This to a certain extent reduces oxidation by air with burnout of the anodes from above.

Application of the protective coating does not lead to complete elimination of emissions, but it will reduce emissions from aluminum production by 3-4%, which relative to 38,000 tons of CO per year will lead to a reduction of at least 1,100 tons per year by increasing the anode lifetime, and consequently reducing anode consumption by no more than 3-4%.

Hybrid bag filter (electrostatic precipitator + bag filter)

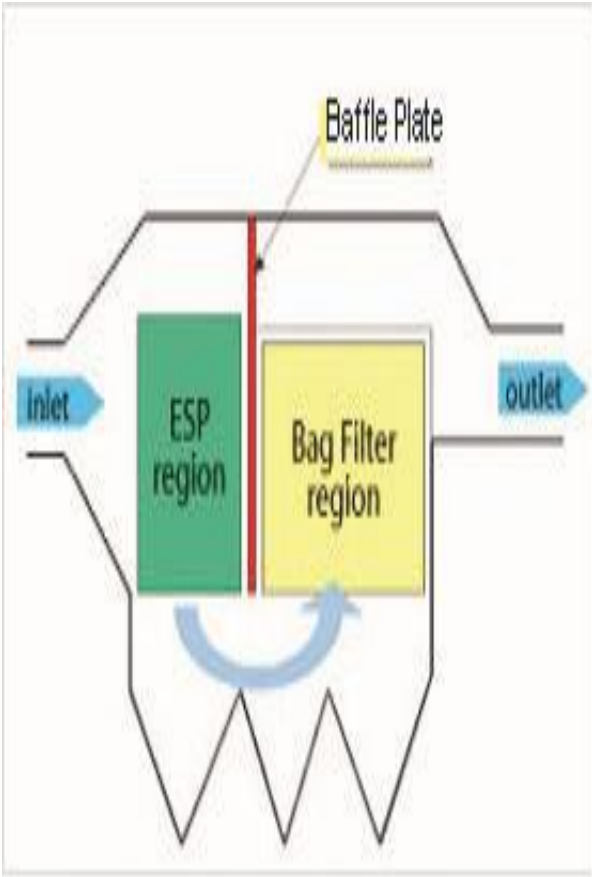
Environmental benefits achieved:

-Reduction of dust emissions through modernisation of gas cleaning equipment, by replacing electrostatic precipitators with hybrid filters.

-Significant reduction of emissions into the atmospheric air.

-Reduced water usage compared to an electrostatic precipitator.

- Reduced production losses/waste compared to bag filter.



Hybrid Bagfilter High Efficiency Filter System

ElectroPlus-Hybrid filter operates '3-stage selective collection' i.e.

1st Stage : Mechanical separation
2nd Stage : Electrostatic separation
3rd Stage : Positive fabric separation

Parameters of hybrid filters

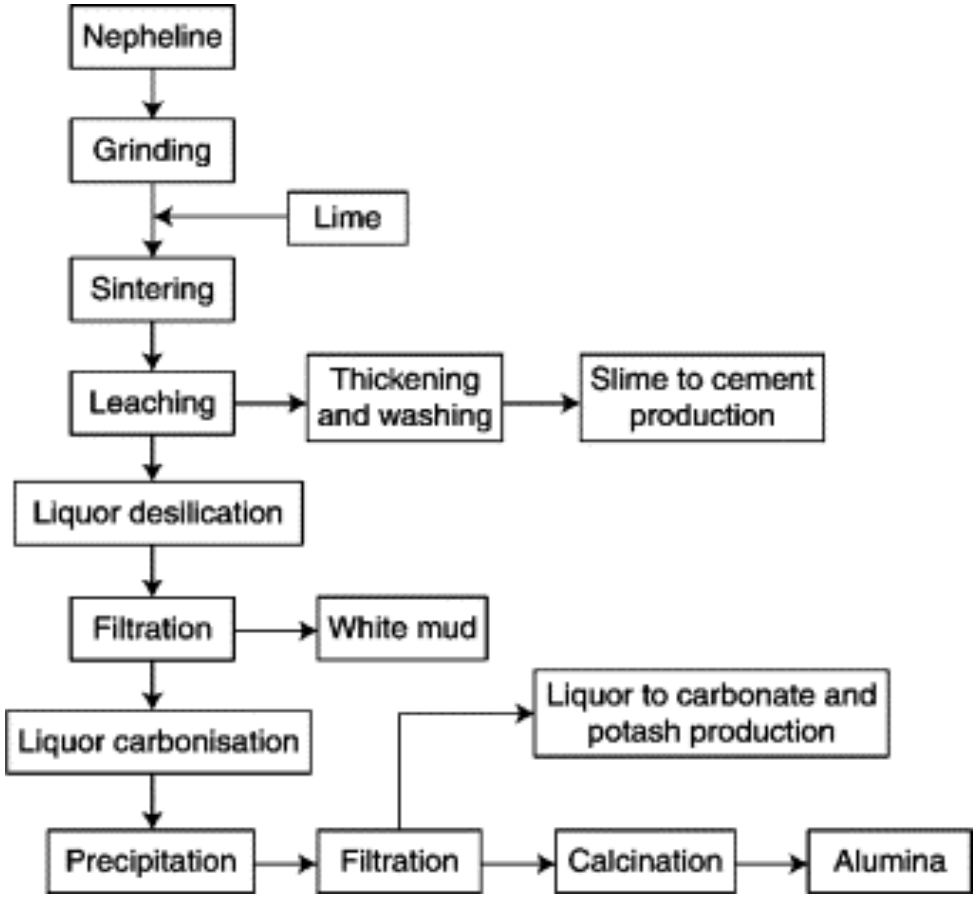
Gas flow	156 000 Nm^3/h
Exhaust gas temperature	up to 425 °C
Smoke exhauster	500 kW
Vacuum	50 mbar
Bag surface (length)	6m.
Particulate matter (dust) content after the furnace, inlet to the hybrid filter	2200 mg/m^3
Predicted result particulate matter (dust) content at the outlet after cleaning	50 mg/m^3
Achieved result	<1,5 mg/m^3

Alumina production by the nepheline sintering method

Integrated processing of nepheline raw materials rationally utilizes all its components and produces soda, potash and high-quality cement along with alumina.

This makes the processing of nepheline raw materials economically feasible despite their relatively low alumina content.

The technological scheme of nepheline processing is based on the sintering method.



$$(Na, K)_2O \bullet Al_2O_3 \bullet 2SiO_2 + 4CaCO_3 = (Na, K)_2O \bullet Al_2O_3 + 2(2CaO \bullet SiO_2) + 2CO_2$$

THANK YOU FOR ATTENTION!

Sevilla 2023