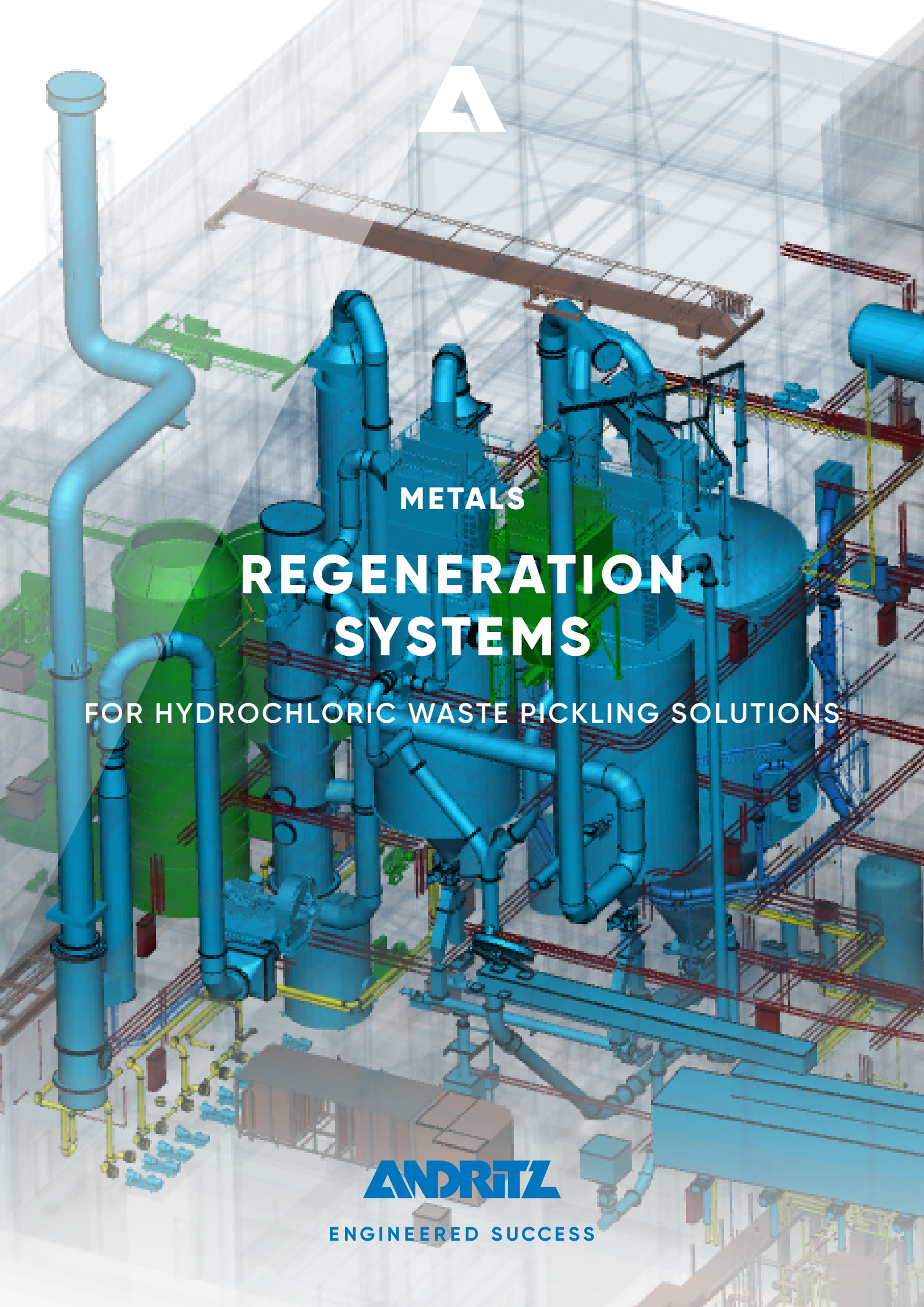


METALS

REGENERATION SYSTEMS

FOR HYDROCHLORIC WASTE PICKLING SOLUTIONS

ANDRITZ

ENGINEERED SUCCESS

The leading acid regeneration technology

THE PROCESS

The dissolved iron is extracted either as iron oxide powder (spray roasting technology) or as sintered iron oxide (fluidized bed technology). Spray roasting is also used to produce other metal oxides from chloride solutions, for example aluminium, cobalt, magnesium, nickel and titanium oxides, rare earth, and various mixed oxides.

When steel is pickled with hydrochloric acid, an iron chloride solution is produced:

- $FeO + 2HCl = FeCl_2 + H_2O$.

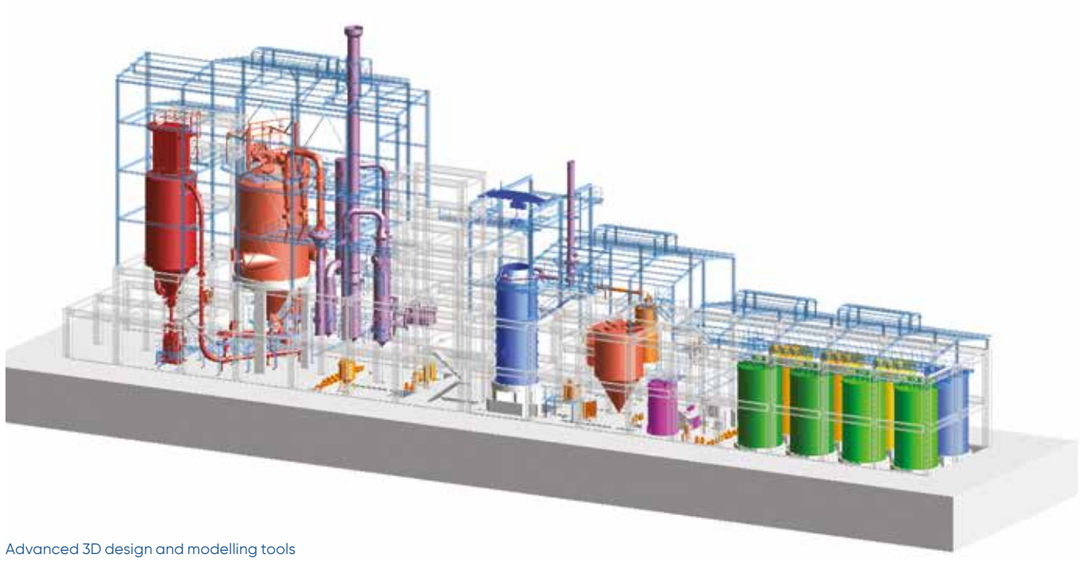
In the regeneration system, the iron chloride ($FeCl_2$) is converted into hydrochloric acid and iron oxide by hydrolytic decomposition.

- $2\,FeCl_2 + 2H_2O + ½O_2 = Fe_2O_3 + 4HCl$

This reaction takes place in the reactor at temperatures ranging from 600° C to 800° C.

The iron chloride containing waste pickling acid from the pickling system is conveyed to the evaporator, where it comes into direct contact with the hot waste gases from the reactor and is concentrated. This concentrated iron chloride solution is sprayed into the spray roasting reactor or fed to the bed of a fluidized bed reactor.

The ANDRITZ spray roasting and fluid bed processes recycle hydrochloric acid with an efficiency of 99.5% for reuse in your pickling line.



Advanced 3D design and modelling tools

Our technologies provide high savings

At reaction temperatures between 600° C and 800° C the iron chloride solution is split into hydrogen chloride and iron oxide by means of water vapor and atmospheric oxygen. After passing through the cyclone, the hydrogen chloride gas, water vapor and combustion gases enter the evaporator and the absorption column, where the HCl gas is absorbed adiabatically by assign rinse water from the pickling plant.

The resulting hydrochloric acid (18% by weight) is recycled to the pickling process. The gas from the column is cleaned in a scrubber stage in accordance with anti-pollution requirements and then discharged to the atmosphere. A fan keeps the system under vacuum, preventing the HCl gas from escaping. Iron oxide powder or sintered iron oxide in the reactor is transported to the appropriate tanks and then filled into big bags.

LOW ACID CONSUMPTION

Acid consumption in pickling plants is substantially reduced when a regeneration system is used.

The following are guideline values for a pickling plant for low-carbon strip, based on 32% percent by weight of hydrochloric acid:

- Acid consumption with regeneration system: 0.5-1 kg/t material to be pickled
- Acid consumption without regeneration system: 18-30 kg/t material to be pickled

Tank farm

Reactor, venturi, absorbion column

THE RELATIONSHIP OF HEAT COMSUMPTION AND IRON OXIDE PRODUCTION

Heat consumption for spray-roasting and fluidized bed reactors as a function of the iron content in the waste pickling acid from the regeneration system:

Fe content in waste pickling acid g/l	Spray roasting reactor kJ/kg iron oxide (Fe_2O_3)	Fluidized bed reactor kJ/kg iron oxide (Fe_2O_3)
80	25,000	25,000
100	22,000	23,000
120	18,000	21,000
140	16,000	21,000

High-quality oxides with WAPUR – Waste Acid PURification

WAPUR is the optimum process for cleaning spent pickling acid. Improved, sustainable oxide quality is achieved with effective and innovative acid regeneration technology.

In a conventional spray roasting process, the metal chloride contained in the pickling acid is converted to metal oxide by thermal decomposition. The metal oxide composition then mirrors that of the pickled base material. With the WAPUR process introduced upstream of the spray roasting plant, much of the unwanted contamination can be removed from the pickling acid. Iron oxide, once a by-product, is thus turned into a valuable material that meets the stringent requirements of the electronics industry.

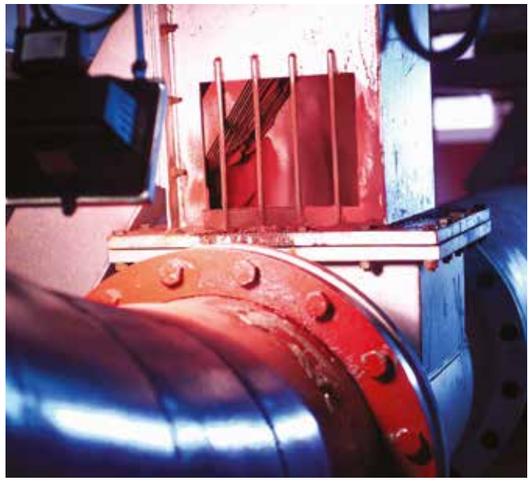
WAPUR PROCESS

The untreated acid is pumped continuously from the waste acid storage tank to a leaching column in the WAPUR system, where it is enriched with iron using scrap from the trimming shears of the pickling line. In the leaching column, the residual free hydrochloric acid in the untreated pickling liquor is bound to the iron. The overflow from the leaching column flows into the reaction tank.

After increasing the pH value, part of the bivalent iron is transformed into iron hydroxide and part of it is oxidized to trivalent iron. This hydroxide then adsorbs other co-precipitated elements.

The particles are agglomerated by adding a flocculant and settle in a sedimentation tank. This slurry is removed in a filter press, while the filtrate – which is very clean waste pickle liquor – is routed to the storage tanks for processing in the acid regeneration plant.

Oxide conveying system



BENEFITS OF THE WAPUR PROCESS

- No waste water
- Can be added to an existing regeneration system
- No additional personnel required
- Adapts to variations in the capacity
- Does not import any changes to the existing regeneration plant's operating procedures
- The iron oxide produced from the "waste" product creates an attractive source of revenue
- The iron scrap used in the process is transformed into high-value iron oxide
- Low utility consumption, continuous operation

Make our experience your advantage

The ANDRITZ spray roasting and fluid bed processes recycle hydrochloric acid with an efficiency of 99.5% for reuse in your pickling line.

WAPUR is the optimum process for cleaning spent pickling acid.

ECO*mode*, the newly developed process for HCl acid regeneration plants, represents the next big step in a series of improvements, and can not only be used for new installations, but also for existing plants.

A closed loop leaching process allows the production of high-quality oxide from metal chlorides (Fe, Ni, Co, Ti, Mg, etc.).

BENEFITS OF THE HCL REGENERATION TECHNOLOGY

- Proven and sophisticated design with more than 250 references worldwide
- Most stringent requirements regarding process technology, reliability, efficiency, and maintenance
- Recycling of hydrochloric acid with an efficiency of 99.5%
- Closed acid loop between the pickling plant and the regeneration system
- Waste pickle liquors containing unwanted elements can be treated
- Rinse water can be used as absorption water in the regeneration plant, thus reducing, or in most cases completely eliminating the requirement of neutralization capacity for the proces
- Reactors can be heated with any gaseous or liquid fuels
- High-purity iron oxide as a by-product with the WAPUR process

Dust separator and injection of waste pickle at the evaporator

Proven and sophisticated design

EXTRACT FROM OUR REFERENCE LIST

Customer	Country	Capacity
Aarti Steels (Nigeria) Ltd.	Nigeria	1,500
Abul Khair Stripprocessing Limited	Bangladesh	3,600
Acciaieria Arvedi	Italy	10,000
Al Ghurair Steel	U.A.E.	2,700
Anyang Iron & Steel	China	11,000
Baoshan Iron & Steel Corp.	China	2 x 7,500
Baosteel Shanghai No. 1	China	9,500
Benxi Iron & Steel	China	12,500
Essar Steel	India	5,000
Guangxi Liuzhou Iron & Steel	China	10,000
Guangzhou JFE Steel Sheet	China	9,500
Handan Iron & Steel Group	China	8,000
Inpromesa F. Sidmed S.A.	Spain	9,000
International Steels Limited	Pakistan	4,500
OJSC Novolipets Steel	Russia	2,700
Rizhao Steel Holding Group Ltd.	China	2 x 20,000
Safal Steel (Pty) Ltd.	South Africa	1,500
Tian Tie Group	China	11,700
thyssenKrupp Steel Europe AG	Germany	9,000
Union Steel	Korea	10,000
Usinas Siderúrgicas de Minas Gerais	Brazil	6,000
voestalpine Stahl	Austria	5,000

OVER 250 REFERENCES WORLDWIDE

REDUCE ECOLOGICAL FOOTPRINT

ADDITIONAL REVENUE

FROM PRODUCTION OF HIGH-VALUE IRON OXIDE

ENGINEERED SUCCESS
FOR FLAT PRODUCT PROCESSING

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