MAGMA

Efficient and clean steel production

2026

INTRODUCTION

Every metallurgical company is challenged by declining resource quality, depleting coking coal reserves, increasing environmental pressures and carbon reduction requirements.

We provide a technology that makes steel production more cost effective, independent of coking coal or high-quality iron ore resources and drastically reduces its environmental impact.

from 100 000 to 1 000 000 tonnes annual capacity

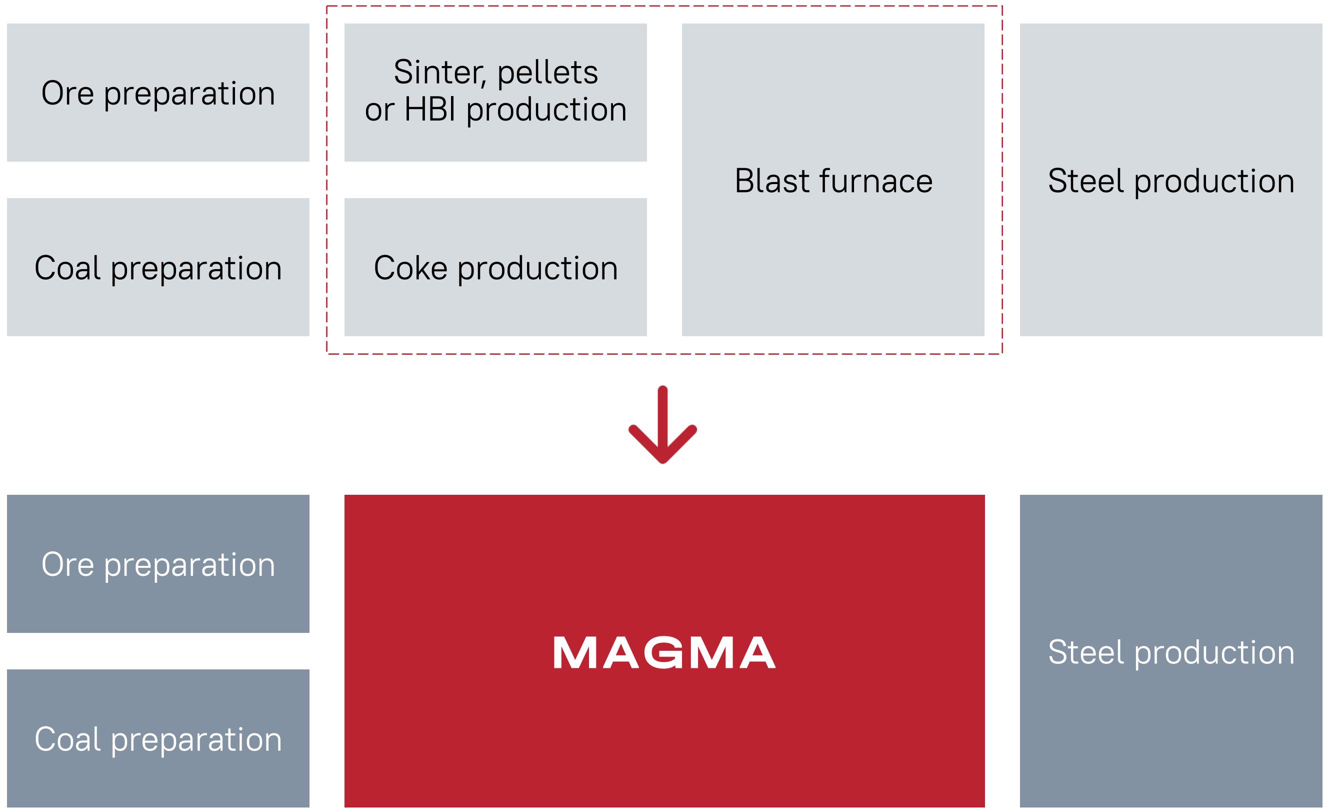
The MAGMA furnace is a continuous unit for coke-free steelmaking for small metallurgical plants with annual capacities from 100,000 to 1,000,000 tonnes, based on the process of liquid phase reduction of iron (Fe).

The MAGMA furnace is used in the first stage to produce pig iron with **Fe content of 95%** and without harmful impurities, directly from iron ore.

The further production of steel from the liquid pig iron is carried out by conventional methods: by converter or EAF with oxygen purging.

Since MAGMA technology does not require coke or coking coal and can use ordinary iron ore instead of sinter, pellets or hot-briquetted iron, MAGMA eliminates many preliminary operations and significantly reduces steel production costs.

MAGMA eliminates coke and agglomeration steps



ADVANTAGES

Operational efficiency

10-20% lower compared to blast furnace production and 30% lower compared to sponge iron production.

Lower capital costs

Simple process design and no large investment in raw material handling reduces the overall investments in setting up a full-cycle steel production facility.

Elimination of coking coals and coke

Possibility to use conventional thermal coal and/or natural gas as a reducing agent and energy carrier.

Flexibility in the use of charge materials

MAGMA can process low grade ore, including ore fines or ore with impurities.

High quality products

In the form of hot metal (pig iron) with Fe content >95%, which can be efficiently processed into high quality steel grades.

Simple production process

Less preparation of charge and coal, possibility to work on unprepared charge material.

Environmentally friendly process

Reduced pollution and CO_2 emissions.

Possibility of utilizing the waste gases for power generation or preheating of charge and air-oxygen blast.

ABOUT MAGMA TECHNOLOGY

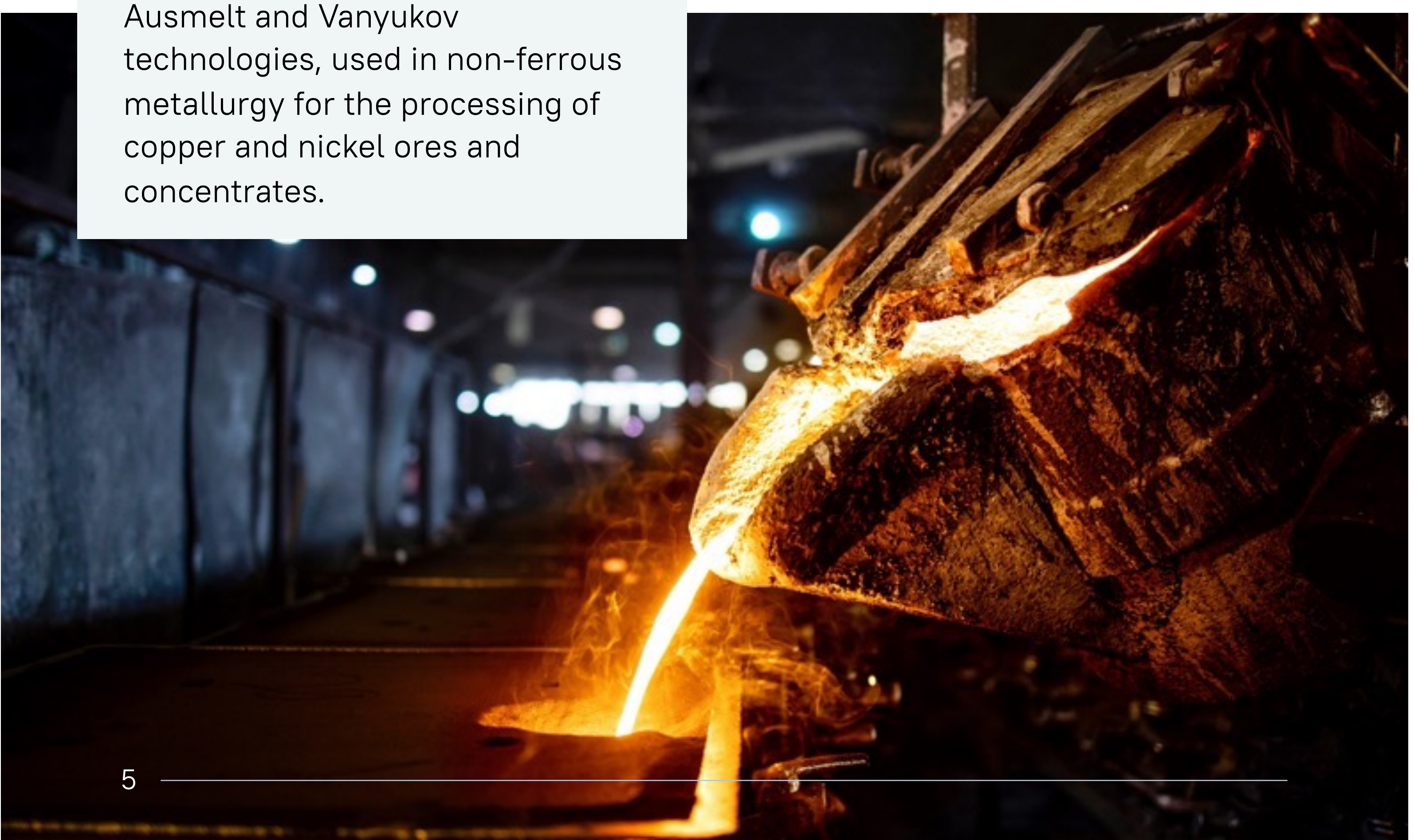
The technology is based on MAGMA's proprietary furnace design and is an evolution of existing technologies for liquid phase reduction of metals that have been actively developed in ferrous and non-ferrous metallurgy over the last 30 years.

The best-known liquid phase reduction technologies are Corex, Finex, HIsmelt, Hisarna and Romelt, used in the production of ferrous products and steel, and the Ausmelt and Vanyukov technologies, used in non-ferrous metallurgy for the processing of copper and nickel ores and concentrates.

To date, more than 30 liquid phase reduction furnaces have bee§n installed around the world.

30+

liquid phase reduction furnaces have been installed worldwide



Advantages of liquid phase reduction technology

The technology involves complete remelting of the feed materials and metal reduction reactions in the liquid state and at high temperatures.

This simplifies feedstock preparation and eliminates the need for expensive coke or iron-bearing intermediates (sinter, pellets or HBI) required by other technologies that require iron recovery in the solid phase.

Features of MAGMA technology

MAGMA technology is based on the experience of existing liquid phase reduction technologies and has a number of innovations to improve production efficiency, reduce coal and oxygen consumption:

- Efficient furnace body cooling system;
- Heating of feed materials and air-oxygen blasting prior to feeding into the furnace;
- Injection system to deliver coal powder straight into the slag melt;
- Intelligent automation and control system.

These solutions are tested and proven in the iron and steel industry.

PRODUCTION PROCESS

The MAGMA furnace can use an unprepared charge (coal, iron ore and limestone).

To optimize energy and oxygen consumption, the charge is pre-dried and heated by the off-gas from the furnace.

Coal and gaseous oxygen (O_2) are used as reducing agents and energy carriers. The oxygen is injected directly into the slag melt through the lances together with coal.

This ensures intensive mixing of the resulting slag melt in the MAGMA furnace and accelerates the iron reduction process.

Natural gas can also be used as an energy source to replace part of the coal.

During the smelting process, iron oxides (Fe_2O_3, FeO) react with the carbon from the coal and are converted to Fe in the form of liquid pig iron. The liquid pig iron accumulates at the bottom of the MAGMA furnace.

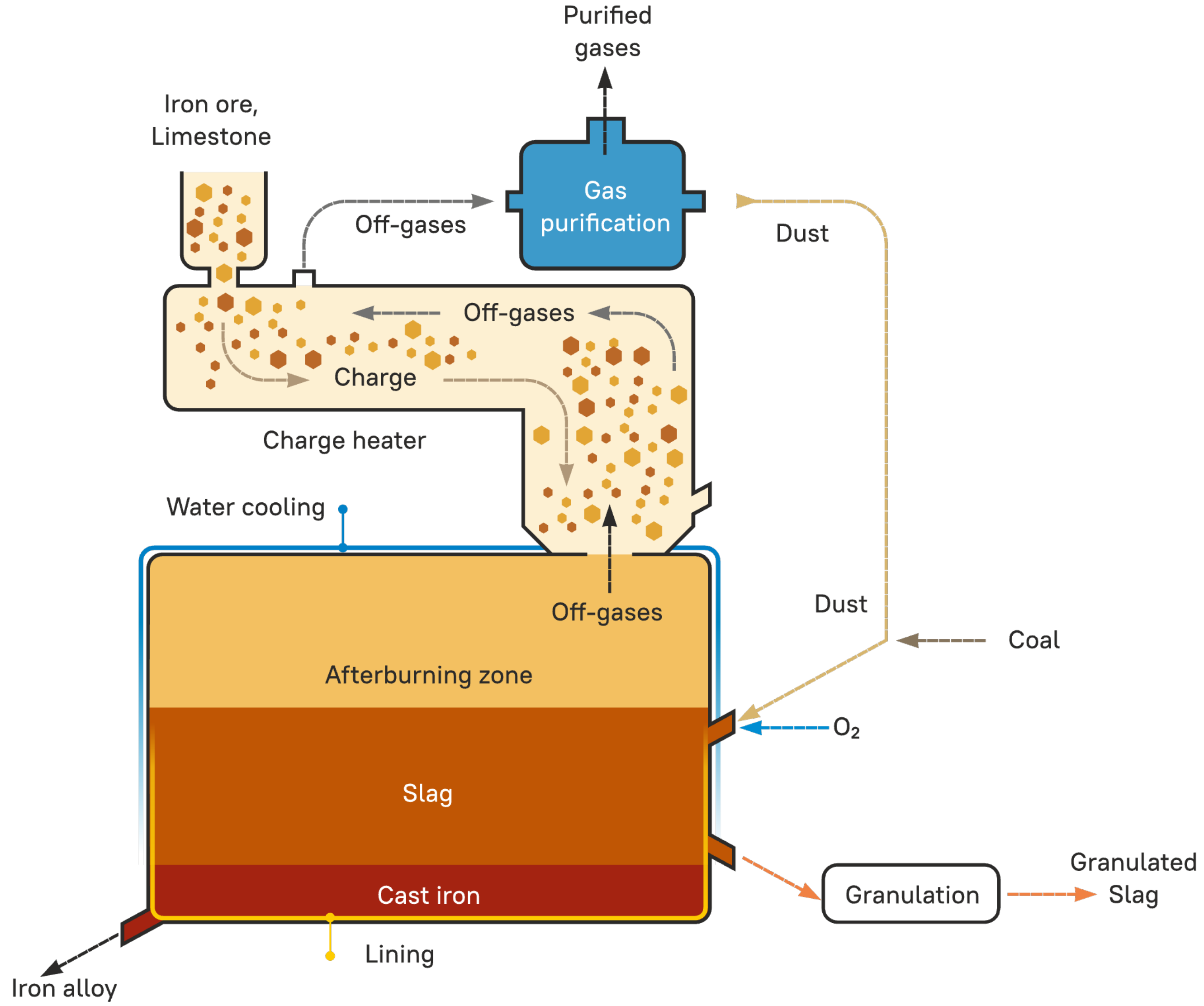
Hot metal (pig iron) from the MAGMA furnace is poured into a ladle and can be further processed into steel in a converter or in an EAF with oxygen purging, without the use of electricity to heat and melt the pig iron.

The chemical composition of the slag from the MAGMA furnace is similar to that of blast furnace slag and can be used in the production of building materials or crushed stone.

The off-gases from the MAGMA furnace can be used to generate its own electricity, for drying and heating the charge and for the air-oxygen blast.

1450°c

temperature of hot metal



Characteristics of produced pig iron

Fe	C	Mn	Si
95 %	4,3-4,5%	0,05-0,11%	0,06-0,11%

ECONOMICS

The elimination of coke and costly charge preparation operations ensures a competitive cost of pig iron production and subsequent steel production.

Under comparable conditions and prices, the cost of producing steel using MAGMA is 10-20% lower than using a blast furnace and 30% lower than using rotary furnaces for sponge iron production.

Average unit consumption rates, per 1 t of hot metal

Item	Unit	MAGMA (coal)	MAGMA (gas & coal)
Iron ore (62% Fe)	t/t	1,62	1,62
Non cocking coal	t/t	0,80	0,40
Fluxes	t/t	0,17	0,17
Natural gas	m^3/t	-	225,00
Oxygen	m^3/t	750,00	550,00

Advantages over the blast furnace process:

- Use of cheaper thermal coal instead of coke or coking coal;
- No need for pre-treatment of ore and use of sinter or pellets, which are on average 20-25% more expensive than lump ore.

10-20%
lower OPEX

Advantages over rotary kiln DRI production:

- Lower coal consumption;
- Reduced iron ore consumption as the MAGMA furnace can process ore fines generated during the transport and preparation of the charge;
- Lower energy consumption in the further processing of liquid pig iron into steel compared to processing iron sponge in an EAF or induction furnace;
- Lower costs for removing harmful impurities from the steel;
- The ability to produce high quality steels and higher margin products.

25-30%
lower OPEX

ENVIRONMENTAL AND ENERGY EFFICIENCY

Low CO_2 emissions

The elimination of coke and the production of ferrous intermediates reduces the total CO_2 emissions produced by more than 20% compared to a blast furnace.

The ability to utilize waste gases for power generation can also reduce overall CO_2 emissions.

20% lower
total CO_2 emissions

Use of production waste

Most of the waste can be effectively utilized, which will significantly reduce the environmental impact.

Slag produced in the MAGMA unit can be used for production of various construction materials: slag-cast rubble or slag-cast products.

Coal and ore screenings, steelmaking slag and other iron-containing wastes can be recycled in the MAGMA furnace.

Off-gas utilization

The off-gas from the MAGMA furnace can be used for the production of electricity, drying and heating of charge and air-oxygen blast, production of steam and other technological needs.

ABOUT US

The developer of MAGMA technology is New Metallurgical Technologies (NMT) a group of companies (Kazakhstan).

The company specializes on the development of efficient, environmentally friendly technologies.

The team includes PhD engineers with extensive experience in the design and manufacture of metallurgical equipment as well as the commissioning of various metallurgical plants in Russia, Kazakhstan, Uzbekistan and Mongolia.

The company actively cooperates with renowned international engineering companies and research centers.

NMT is ready to provide the full range of services related to the implementation of MAGMA technology:

- consulting and preliminary engineering,
- engineering and equipment supply,
- production start-up and after-sales services.

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