Outokumpu Technology offers unrivalled solutions for processing iron ores. These include two leading pelletizing technologies that guarantee high product quality and low operating costs – the Traveling Grate process for plants with large capacities and the Steel Belt process for those with smaller ones.

Pelletizing turns very fine-grained iron ore into balls of a certain diameter, also known as pellets, which are suitable for blast furnace and direct reduction. Pellet plants can be located at mines, near harbors or be attached to steel mills. Equipped with advanced environmental technology, they are almost pollution-free, generating no solid or liquid residues.

Why pelletize? In the face of shrinking world reserves of high-grade ores, ores must now be concentrated before further processing. Pellets form one of the best options, thanks to their excellent physical and metallurgical properties. Moreover, due to their high strength and suitability for storage, pellets can be easily transported over long distances, with repeated transshipments if necessary.

Pellets’ benefits:
- Standardization – uniform size range, generally within a range of 9–16 mm
- Purity – 63–68 % iron, mainly Fe₂O₃
- Cost-effectiveness – virtually no loss on ignition while a high and uniform porosity of 25–30 % allows fast reduction and high metallization rates
- Strength – high and uniform mechanical strength even under thermal stress in reducing atmospheres
- Transportable – low degradation under abrasive influences

The Outokumpu partnership

As one of the world’s leading developers and suppliers of technology, Outokumpu Technology designs and delivers plants, processes and equipment tailored to each customer’s needs. We provide engineering, project and support services for the minerals processing and metallurgical industries globally.
Prior to the formation of green pellets, water is added to the fine iron ore to adjust the moisture content to approximately 9% and the ore is mixed with small amounts of binding agents such as bentonite (approximately 0.5%) and fluxes such as limestone, lime olivine and dolomite (1–5%). These give the pellets the proper physical and metallurgical properties needed in further processing. Mixing takes place in continuously operating drum or pan-type mixers with a capacity of 450–700 t/h.

**Green pelletizing**

On an industrial scale, green pellets are formed either in pelletizing discs or drums, drums usually being connected to roller screens used for separating undersized pellets (150–250 %) which are returned to the drum. This high level of circulation makes pelletizing drums less sensitive to variations in feed material properties. Pelletizing discs need only a single process step to form pellets, their classifying effect discharging the pellets from the disc rim within a very narrow size range. Green pellet size can be precisely adjusted by varying the disc inclination, circumferential speed, feed rate or water addition.

**Customized comminution creates lower capital and operating costs**

The São Luís pelletizing plant in Brazil is our most modern reference plant and the first pelletizing plant in the world, where pellet feed is produced by roller press comminution only. Two roller presses process the fine ore at original moisture levels as received from the Carajás mine. This allows the elimination of big thickeners and of the entire filtration section, hugely simplifying the grinding circuits.

In green-field projects or plant expansions high-pressure roller presses can be combined with conventional ball mills. Such roller press comminution offers much lower capital and operating costs as regards civil engineering, structural steels and engineering as well as equipment costs compared to conventional grinding.

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**The Lurgi Traveling Grate process for larger capacities**

The Traveling Grate process, chiefly developed by Lurgi (now owned by Outokumpu Technology) accounts for two thirds of the world’s installed pelletizing processes.

It comprises three steps:
- Raw material preparation
- Forming green pellets
- Pellet hardening

**Innovative raw material preparation process for lower energy consumption**

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Since green pellets have low mechanical strength, they need to be hardened for the processes, which will follow. To do this, we apply the Lurgi Traveling Grate, best thought of as an endless chain of pellets. A roller conveyor, for example a double-deck roller screen with each deck separating out oversized and undersized pellets, ensures that only pellets of the right size (generally 9–16 mm) are evenly distributed across the width of the traveling grate. The grate carries the green pellets on a bed 30–50 cm thick through a furnace with updraft drying, downdraft drying, preheating, firing, afterfiring and cooling zones. A major advantage of the traveling grate is that the green pellets remain undisturbed throughout the process. The homogenous pellet charge on the traveling grate reduces the pressure drop within the furnace, minimizing energy consumption. It further enables even heat treatment, which results in high-quality pellets.

The indurating furnace.

**Better induration improves quality and lowers cost**

**Economical and environmentally friendly gas flow concept**

A range of recuperation techniques are applied to the gas flow for the traveling grate, enabling maximum reduction of fuel consumption and gas emissions:

- “Direct recuperation” of heated process gases (850–1,000°C) from the first cooling zone, transferring the gases onwards to the preheating and firing zones
- “Windbox-recuperation” of exhaust gases (approximately 350°C) from the windboxes to the downdraft drying and preheating zones
- The use of exhaust gases from the cooling zone (approximately 350°C) for updraft drying

Five or six major process fans maintain gas flow efficiently. While the cooling air fans draw in fresh air, the windbox exhaust fan and hood exhaust fan expel around two thirds and one third of off-gases respectively. Gases are recuperated by the windbox recuperation fan.

**Reduced environmental impact**

Traveling grates comply with stringent environmental regulations through their gas cleaning systems for example multi-clones and electrostatic precipitators.

**Maximizing solid fuel means lower running and installation costs**

Using coal as a solid fuel inside green pellets is standard in hematite pelletizing plants around the world. However, our unique indurating machine design maximizes the efficiency of coal combustion, which can generate up to 50 % of the total energy input. The resultant need for fewer burners, burning chambers and process gas quantities saves on installation as well as running costs.

**Range of burners gives greater control**

An array of burners in the preheating and firing zone enable a precisely controlled firing pattern, yielding the following advantages:

- Superior process flexibility
- Easily adjustable temperature profile
- Adaptation of different firing profiles for changing feed materials
- Quality pellets at all feed rates without damage to equipment

Our pelletizing process uses hearth and side wall layers consisting of indurated pellets recirculated from production, enabling the firing of the entire bed of green pellets and protecting the grate bars from damage due to over-heating.

**Optimized drying sequence means lower fuel consumption**

In pellet drying, we have reduced fuel consumption significantly through our optimized updraft and downdraft drying sequence.
Facts about Traveling Grates

- Traveling grate dimensions
  - 110–768 m² reaction area
  - 2.5–4.0 m machine width
- Capacity
  - 0.35–7.25 million t/a in single unit
  - availability 330–350 days/year
  - specific production rates (grate factor) between 15 t per day m² for weathered ores and > 35 t per day m² for high-quality magnetites
- Consumption figures
  - between 240,000 MJ heat/t pellets for natural magnetites and 1,500,000 MJ heat/t pellets for limonites
  - 25–35 kWh/t electric energy for mixing, balling, and induration, depending on raw material and plant capacity
  - 0.05 m³ fresh water/t pellets for cooling water circuits
- Product qualities
  - pellets for blast furnaces and direct reduction processes
  - cold compression strength ≥2,500 N/pellet
  - tumble index ≥6.35mm ≤ 95 %
  - abrasion index ≥0.5mm ≤ 5 %
  - pellets 9–16mm > 85–90 %
  - fines ≤1mm ≤ 1 %
  - high porosity, reducibility, and metallization degree

Process’ advantages:
- Use of a single unit for pellet drying, preheating, firing, and cooling:
  - pellets remain undisturbed throughout the entire process (including cooling)
  - uniform heat treatment
  - minimized dust and fines generation
  - no intermediate strength requirement
- Several burners in preheating and firing zones:
  - superior process flexibility
  - adjustable temperature profile
  - adaptation of different firing profiles to changing raw materials
- Stationary refractories, grate maintenance offline:
  - low maintenance costs and high availability
- Several recuperation techniques:
  - low specific heat consumption
  - heat transfer by convection instead of radiation
  - uniform heat treatment, leading to uniform product quality

Advanced Steel Belt Sintering for smaller capacities

Steel Belt Sintering SBS™

Since traveling grate plants are most efficient with 3–7 mt/a production capacities, we have developed steel belt technology for production of 80,000–1,000,000 t/a. This innovation is designed for the cost-effective agglomeration of smaller quantities of chrome ore, iron ore, manganese ore or niobium ore as well as for steel plant residues.

Steel belt plants differ from traveling grate plants in terms of the lighter design of their indurating machines and process gas systems. Green pellets are transported through the indurating machine by a perforated steel belt instead of pellet cars, while heat is generated by the combustion of carbon inside the pellets and by auxiliary burners in the gas duct between the cooling and firing compartments.

Comprehensive test facilities

Over the years, our own research centers in Germany and Finland have played a major role in successful pellet plant design and construction projects. The test series yield specific data for optimal plant design in both technical and financial terms. Our R&D centers boast a full range of facilities for testing pellet properties according to international standards such as D0, ASTM, JIS, and DIN.

In order to optimize the entire process from run-of-mine ore through to fired pellets, we are performing pellet tests in conjunction with comminution and beneficiation test.
Outokumpu Technology is a worldwide technology leader in minerals and metals processing, providing innovative tailored solutions for a wide variety of customer needs in the iron and steel, aluminium and non-ferrous metals industries.