

ISASMELTM gives you flexible, clean smelting for the real-world

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GLENCORE TECHNOLOGY

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ISASMELT[™] has been producing matte from concentrates and secondary materials for more than 40 years.

More than **10.35 million tonnes** of feed per year are treated in **15 ISASMELT™ plants** around the world in Australia, USA, Germany, Belgium, Zambia, Peru, and Kazakhstan.

At a glance

- → ISASMELT[™]'s top submerged lance (TSL) smelters are low in capex and opex, low in maintenance and easy to run.
- → ISASMELT[™] ramps up to 100% of design capacity in just a few months.
- → It's flexible so you can change feed as your run-of-mine ore changes.
- → It has a small footprint so it can be installed in greenfield or brownfield operations.
- \rightarrow And its environmental performance is world class.



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Why ISASMELT[™] is the world's highest-performing smelting furnace

The high intensity of the ISASMELT[™] process results in high productivity from a relatively small diameter furnace. This means a small footprint, lower installation costs, straightforward maintenance and cost effective operation.

1. Flexible

ISASMELT[™] is flexible for the real world. Feed compositions and opportunities change over time and ISASMELT[™] can adapt to those changes.

2. Variable feed

Unlike other smelters, ISASMELT™ can take both coarse and fine feeds. For coarse materials, you'll simply drop it directly into the furnace. For fine feeds, you'll agglomerate the fine materials to keep dusting super low.

3. Fast ramp-up

The ramp-up to the designed capacity of a newly built ISASMELT™ is fast – three months instead of a number of years.

4. Lower cost

ISASMELT[™] has lower operational expenses and maintenance. For example:

- Rebricking your ISASMELT™ furnace is quicker and easier.
- ISASMELT[™] lances are cheaper to maintain and faster to replace.
- There are fewer copper blocks to monitor and they last longer.
- The ISASMELT[™] furnace is easier to learn, simpler to operate, and more robust to handle any upset conditions.

5. Higher availability

ISASMELT[™] availability is well over ninety percent. The availability of other smelters can be two to five percent less. That translates to a lot of revenue.

6. Long campaigns

ISASMELT[™] can be operated for long campaigns between furnace repairs, up to four times longer than other furnaces operating similar processes. You can expect a four-year campaign for a typical ISASMELT[™] furnace and some have demonstrated more than six years on a single refractory lining!

7. Advanced control systems

ISASMELT[™] has advanced control systems to minimise fugitive emissions and deliver a world-class environmental result.

8. Advanced safety

ISASMELT[™] has advanced safety and design features at all locations where operators work to ensure they are safe.

9. Advanced instrumentation

Advanced instrumentation and controls allow ISASMELT™ to stay running in the optimum operating window. Other furnace technologies struggle to optimise.

10. Simple, safe tapping

ISASMELT[™] tapping systems are simple, safe, easy to operate, and highly reliable.

11. Technology transfer

Technology transfer from the ISASMELT[™] team to you, our client, includes training at an existing operational ISASMELT[™] site, hands-on help commissioning and hands-on help to ramp-up your ISASMELT[™]. Along the way, we help solve any technical problems.

12. Community knowledge sharing

We have a licensee community who talk with us and each other, helping us all improve our operations. When you're an ISASMELT™ licensee, you're part of that community. We have private workshops, online webinars, and conferences at site.



ISASMELT[™] is flexible for all applications

ISASMELT[™] can be used for a range of applications including primary and secondary copper smelting and copper converting, primary and secondary lead smelting, primary nickel smelting and converting, and tin, zinc and precious metals smelting.

Since its introduction to the marketplace, the ISASMELT[™] process has had the highest adoption rate of any base metals smelting process.

The ISASMELT[™] process is installed in countries with major lead and copper smelting and converting operations around the world, including Australia, USA, Belgium, Germany, Great Britain, India, Malaysia, China, Peru, Zambia and Kazakhstan.

In the copper industry, the ISASMELT[™] process has been rapidly accepted, resulting in a transformation of the copper smelting industry. The total capacity of copper ISASMELT[™] plants is over 10,000,000 tonnes per year (t/y) of copper bearing feed.



Perfect for secondary smelting applications

For the emerging e-scrap and clean/ green copper sector, ISASMELT[™] is the ideal fit. Low in emissions, efficient, low in capital cost and well proven in the treatment of e-scrap, ISASMELT[™] is the fastest and most commercially viable option for you if you are in this emerging sector.

Our furnace sizing ranges from the F600, which can fit inside a small warehouse, to the F5500 which is our traditional sizing and capable of processing well over a million tpa.

You can efficiently process for copper, gold, tin and nickel sulphate products. And your ISASMELT™ furnace will produce only by-products, not waste. It's an ideal solution for existing operations wanting to expand to this sector, for scrap collectors and waste collectors.

Importantly, both Glencore and Glencore Technology have experience in running e-scrap operations, and we use this experience to design, install and train. We can also retro-fit existing ISASMELT™ technology to include the processing of e-scrap and we can even assist non-ISASMELT™ furnaces to adopt ISASMELT™ technology to improve their performance.

We can also offer you supply, offtake and financing agreements through Glencore.

How ISASMELT™ has grown to be the preferred furnace

The ISASMELT[™] process allows new operations to reach design capacity quickly and cost-effectively and enables brownfield operations to improve profitability and meet stringent environmental standards. These operations have recognised the superior results delivered by the ISASMELT[™] process in copper and lead smelters around the world.

For new greenfield plants, the ISASMELT[™] process has made entry into the smelting marketplace a straightforward, less expensive decision. The ISASMELT[™] process requires much less up front capital than its alternatives. The innovative design, combined with Glencore Technology's training and commissioning services means that the smelter can be rapidly commissioned to achieve design capacity at a much faster rate. For an investor in the industry this means faster time to profitability.

New operators can clearly see the innovation developed by Glencore Technology. This innovation is not only in the equipment but also in the design and skill passed on during training, commissioning and ongoing support.

This results in quick ramp-up to design capacity, long refractory campaigns and low operating costs.

ISASMELT™ performance in detail

High production capacity	The high intensity smelting process results in high productivity from a relatively small diameter furnace. Using a single ISASMELT™ furnace of 4.4 metres in diameter, Kansanshi Mining PLC treats over 1.38 Mtpa of copper concentrate
Demonstrated rapid ramp-up to design capacity	Glencore Technology's complete package of detailed design, equipment supply, training and commissioning, ensures that ISASMELT™ start up is smooth, and that quick ramp-up to design capacity is achieved. Glencore Technology's operating expertise has assisted Kansanshi Mining PLC to reach design capacity in just three months.
High volatilisation of impurities	The turbulent bath in the ISASMELT™ process ensures efficient removal of volatile elements into the offgas stream. The majority of arsenic, for example, is removed from the molten bath into the offgas stream and can be bled out of the smelting process through the offgas cleaning system.
Environmentally friendly technology	ISASMELT [™] technology can meet the most stringent environmental guidelines and has demonstrated virtually zero fugitive emissions, with extremely efficient offgas capture. For example, the carry-over of dust from an ISASMELT [™] furnace into pollution control equipment is much lower than alternative technologies. Dust from mechanical carry-over is approximately 1% of feed weight. This results in much lower recycle of dust and lower operating and capital costs for dust capture and recirculation systems.
High specific smelting rate	The ISASMELT [™] lance is submerged in the slag, providing an extremely turbulent molten bath. When the raw materials enter the bath they are immediately drawn beneath the surface and react very quickly. This enables a comparatively large amount of raw material to be processed.
Innovative low cost furnace	The stationary vertical cylinder shape of the furnace allows it to be bricked easily. The furnace construction requires less maintenance than other processes, which rely on rotating furnaces, water-cooled panels and complex systems for injecting gases and solids through the walls or roof of the furnace. The lance can be removed from the furnace easily at any time if maintenance is required, with smelting continuing using a new/refurbished lance inserted from the waiting rack. Typical lance maintenance involves the replacement of the tip section of the lance.
Low cost operation	The ISASMELT™ process achieves a low total operating cost through a combination of minimal maintenance, high-energy efficiency, and low personnel requirements. Smelters utilising the ISASMELT™ process are amongst the lowest-cost smelting facilities in the world.
Flexible technology	The ISASMELT™ process is extremely flexible. Furnaces can be custom designed to meet the needs of the client while minimising capital cost. Lance oxygen enrichment ranges from 21% to 90%. The process has been used for primary and secondary (scrap) copper smelting, copper converting, primary and secondary lead smelting, and nickel smelting.
Flexible design	The ISASMELT™ TSL process can be adapted from the smallest to the largest plant throughputs. Glencore Technology can customise the design to meet the client's varying needs in feed materials and production capacity.
Minimal feed preparation	Raw materials only need to be mixed in a drum or paddle mixer. Fine grinding and drying are unnecessary. In secondary smelting, large lumps of raw materials can be fed directly into the bath. For example, in one smelter, scrap copper up to 300 mm in length is incorporated in the continuous feed mix.
Ease of operation	A modern distributed control system is used for overall plant control. Sophisticated algorithms have been developed over the years in Glencore's own operations to simplify control of critical process parameters. Compared to other processes, operators can learn the process quickly.
Easy stop and start-up procedures	The ease of stopping and re-starting the ISASMELT™ furnace is a significant operating advantage. Typically the furnace can be stopped within 20 seconds and re-started within five minutes. Cold re-starts, due to extended shutdowns (greater than two days), are also straightforward with return to smelting typically taking less than four hours.
Flexibility in fuel types	The ISASMELT [™] process can use most types of coals, petroleum coke, coke breeze, oil (including recycled oil), propane or natural gas for fuel. An ISASMELT [™] furnace can be designed to use the cheapest available fuel, and can be adapted in the future to other types should fuel costs change.







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How ISASMELT[™] works

ISASMELT[™] uses an innovative top-submerged lance and furnace design to deliver flexibility, performance and the lowest environmental impact.

ISASMELT[™] is a high-intensity smelting process that can be used in either continuous or semi-continuous operation.

It uses an extremely efficient Top Submerged Lance (TSL) technology and a stationary refractory-lined furnace.

The lance tip is submerged into the bath of molten slag. Air, oxygen and fuel are fed down the lance into the molten bath, creating a highly turbulent environment that promotes very rapid reaction of raw materials. The ISASMELT[™] process can be used for a range of applications. Depending upon the application, the raw materials may consist of concentrates, metalbearing residues, metal scrap, fluxes and solid fuel if required. These materials are typically fed on a continuous or semicontinuous basis through a port in the furnace roof.

The ability of the ISASMELT™ process to handle a wide range of feed materials, in an environmentally friendly manner, also makes it ideal for recycling applications. The Umicore and Aurubis recycling plants in Europe utilise ISASMELT[™] technology in their highly successful secondary copper plants. These operations treat electronic waste, metal bearing residues, shredder materials, copper scrap, matte, slag and dusts to produce copper, lead and tin alloys and precious metals.

The ISASMELT™ furnace

Air, oxygen, fuels and solids

Oil, natural gas and/or solids or solid fuels can be injected down the lance with combustion air. Air can be enriched with oxygen.

Offgas and fume

The stationary furnace design allows efficient offgas collection and maximise offgas strength while minimising solids carryover.

Agglomerated feed

Wet, agglomerated feed can be charged directly to the furnace with no further treatment.

Patented lance design

The submerged lance design promotes formation of a frozen slag layer on the lance tip.

Refractory-lined

Simple furnace design reduces capital cost and allows problem free, rapid refractory installation.

Frozen slag coating

The slag coating on the lance tip protects it from wear by the molten bath.

Taphole

One or more water-cooled tapholes can be used for molten product removal.

Vigorously stirred bath

The submerged lance creates a highly agitated bath ensuring rapid chemical reactions and good mixing.





40 years of continuous evolution and performance

After more than 40 years of continuous development, the ISASMELT™ design provides you with flexible, clean, effective and low cost smelting.

The ISASMELT[™] process was developed by Mount Isa Mines (a subsidiary of Glencore) and is based on the patented SIROSMELT lance that was invented by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) of Australia.

The first demonstration scale lead ISASMELT™ furnace was commissioned in Mount Isa, Australia, in 1983. This was followed by demonstration and commercial scale copper and lead smelters commissioned at Mount Isa.

The success of these plants prompted further licensing to external clients. The ISASMELT™ is now in production in a variety of applications around the world, and with each installation, improvements in design and operation are made and these are available to all customers.

We'll create for you the best fit for purpose smelter

Glencore Technology's highly experienced team of engineers, metallurgists and operators work closely with your team to create the best design and installation for your needs.

We provide support to you along every step of the project, including:

- regular project meetings
- site visits during the design phases
- construction supervision

- hands-on training in an operating smelter
- specialist support during proprietary equipment installation and commissioning and advice on how to optimise plant performance following start-up.

Then we provide ongoing support to you following commissioning. We encourage frequent interaction between our own team and yours, as well as interaction between your own teams.

Technology partnership: the ISASMELT™ Success Zone

We hold regular licensee workshops, hosted by ISASMELT™ customers, during which you'll join other personnel from smelters all around the world to compare operating techniques and discuss how to improve profitability.

Glencore Technology's metallurgical teams are backed by world class engineering and mechanical teams. We use these to build with you the ISASMELT™ Success Zone.

We blend Process, Mechanical and Operation expertise to cover all aspects of your smelting operation's success from design through to optimised operating. It means things happen right the first time and from the beginning. Glencore Technology offers a range of services that are customised to meet your needs. This includes:

- feasibility studies
- pilot plant testing
- engineering design
- supply of specialised equipment and spares
- process and operational training
- commissioning assistance and plant optimisation assistance.



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Glencore Technology

Glencore Technology develops innovative products that help mining operations extract more from their flowsheet. ISASMELT™, IsaKidd™, IsaMill™, Jameson Cell and Albion Process™ have been developed in the real world and proven in more than 500 operations across every continent.

Many of our technologies have been developed and proven at our own sites, like ISASMELT^M and IsaMill^M, which were pioneered by Mount Isa Mines and helped revolutionise mining and smelting processes all over the world.

Our approach is premised on a technology partnership to provide a full product and service offering, including process flow design, engineering, equipment supply, commissioning and operational expertise, and ongoing process and maintenance support.

Glencore

Glencore is one of the world's largest global diversified natural resource companies and a major producer and marketer of more than 90 commodities. The Group's operations comprise around 150 mining and metallurgical sites, oil production assets and agricultural facilities. With a strong footprint in both established and emerging regions for natural resources, Glencore's industrial and marketing activities are supported by a global network of more than 90 offices located in over 50 countries.

Glencore's customers are industrial consumers, such as those in the automotive, steel, power generation, oil and food processing sectors. We also provide financing, logistics and other services to producers and consumers of commodities. Glencore's companies employ around 146,000 people, including contractors.

Glencore is proud to be a member of the Voluntary Principles on Security and Human Rights and the International Council on Mining and Metals. We are an active participant in the Extractive Industries Transparency Initiative.

CONTACT

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