THE MITSUBISHI PROCESS

COPPER SMELTING FOR THE 21ST CENTURY

MITSUBISHI MATERIALS CORPORATION
www.mmc.co.jp
Our atmosphere, the air we breathe, is common to all of Earth’s inhabitants. Our planet provides us with abundant natural resources........clear waters........bountiful seas........fertile lands........and verdant forests. All must be carefully nurtured, widely enjoyed, understood, appreciated, and most important of all, must be protected and sustained for the benefit of future generations. Since the inception of the Mitsubishi Process, we have constantly challenged our own technology, striving to make it more efficient, and ever friendlier to the environment.

The “Mitsubishi Continuous Smelting and Converting Process” which we have evolved from years of research and production experience, is the world’s only commercially proven pyro-metallurgical process to produce blister copper continuously from concentrates.

It is “THE PROCESS” for the 21st Century.

The Mitsubishi Process ensures environmental protection of the surrounding community, clean and safe workplace conditions, and the highest copper, gold, silver and sulfur recoveries in the copper industry. Its operating costs are low and the cost of plant construction is keenly competitive. These are but a few of the many technological aspects, which we will cover more fully in the following pages.
IN PURSUIT
OF AN IDEAL SMELTER

The Mitsubishi Process:
A step ahead of the rest
Copper has been recognized as a valuable resource since ancient times. Mitsubishi Materials has sought to optimize the smelting of this valuable resource for many years. We believe the ideal smelter should be environmentally friendly, highly efficient, and inexpensive to build and operate. Our Mitsubishi Process attains all of the above goals.

Unique structure that stresses environmental friendliness
From the start of its development, the Mitsubishi Process has aimed at eliminating fugitive emissions from furnaces and ladles. Thus the Mitsubishi furnace arrangement consists of three stationary furnaces, connected by enclosed launders, continuously producing blister copper from concentrates. Furnace charging and tapping are eliminated, so no ladles and cranes are required, and there are no fugitive emissions. These are the basic reasons why the Mitsubishi Process is so clean to operate, and why it has such an unique structure. As demonstrated daily by our family of smelters at Naoshima, Kidd Creek, Onsan, and Gresik, the use of the Mitsubishi Process has elevated their copper smelting to “clean industry” status. An important and lasting advantage in complying with more stringent environmental regulations in the future.

Half a century of development
1959 Testing of injection feeding began, one of the cornerstones of the Mitsubishi Process.
1970 Successful completion of continuous smelting and converting pilot plant testing.
1974 First commercial scale Mitsubishi Process plant with 48,000 MTPY production capacity, commenced operations in Naoshima.
1981 Second commercial scale Mitsubishi Process plant with 60,000 MTPY production capacity, commenced operations at Kidd Creek Smelter in Canada.
1982 Production capacity was doubled at Naoshima to 96,000 MTPY.
1988 Production capacity at Kidd Creek doubled to 125,000 MTPY.
1991 New larger Mitsubishi Process line with production capacity of 200,000 MTPY started operating in Naoshima, replacing operations using the reverberatory furnace + P.S. converters and the original Mitsubishi Process line.
1998 New Mitsubishi Process smelter started at Ondsan, Korea, with production capacity of 160,000 MTPY.
1998 New greenfield Mitsubishi Process smelter started at Gresik in Indonesia, with production capacity of 200,000 MTPY.
2000 The first stand alone Mitsubishi C-furnace started operating at Port Kembla Copper, in Australia in place of previously used P.S. converters.
2000 Naoshima’s production capacity increased to 270,000 MTPY of anodes from new source.
2001 Naoshima Smelter accredited with ISO 14001.
from the bottom of the furnace to a covered launder, flowing continuously into the C-furnace.

**C-furnace**

The Converting furnace (C-furnace) removes the remaining iron and sulfur from the copper matte, producing “blister” copper (about 98.5% Cu). The C-furnace is similar to the S-furnace, but smaller in diameter, and uses identical vertical blowing lances to inject limestone flux, coolant, and oxygen enriched air. Over 30 years ago, Mitsubishi carefully selected, researched, and pioneered the use of limestone for the continuous conversion of matte to blister. This lime-ferrite slag (Cu₂O-CaO-Fe₃O₄) has a lower viscosity and a much higher solubility for magnetite than silicate type slags. The choice of limestone as the C-furnace flux was one of the key factors in the successful development of the Mitsubishi Process, still the only technology to embody continuous converting. The relatively small
Today, Pierce-Smith converters (P.S. converters) coupled with various types of smelting units, are used in most of the world’s smelters. However, due to “batch” processing and problems associated with fugitive emissions during the transfer of melt and blowing stages, this arrangement will not be acceptable in the future.

Modern day alternatives include the Mitsubishi Process, Outokumpu Flash Smelting and Flash Converting Process, the Noranda Process, and the Ausmelt Process. Only the Mitsubishi Process is a “truly continuous” smelting and converting operation producing a constant flow of blister without tapping, and is economically proven by long term commercial operations. Its low capital and operating costs are well demonstrated over many years.

High reliability

While processes like the Flash Process have some advantages from the decoupling of their smelting and converting operations, its operating and capital costs are quite high. The Mitsubishi Process is a continuous “pipeline” with greater cost efficiency, and higher reliability of operations makes decoupling unnecessary.

Effective bath smelting

Furthermore, in the Flash Process, solid materials react in the gas phase, and consequently dust and carryover rates are high. However, in the Mitsubishi Process, the injected solids are pinned down into the bath, with little carryover. Effective bath-smelting by top blowing lances also allows materials such as coal, flux, and granulated slag particles as large as 3mm in diameter to be charged to the bath. Feed materials need not be finely ground and specially dried as in flash processing.

Effective heat utilization

Although the Mitsubishi C-furnace is normally operated with an oxygen enrichment around 32-35%, the level can be adjusted freely to suit the need of each individual smelter. For instance, in order to reduce the size of gas handling facilities, oxygen enrichment can be increased, and excess heat absorbed by charging additional copper scrap, sludge or recycled C-slag as coolant. Conversely, in areas where the cost of oxygen is high, lower enrichment levels can be used, and additional energy credits recovered as steam.

Ideal for scrap melting

In contrast to quiescent furnaces, which are not suited towards the re-melting of scrap materials, the Mitsubishi S and C-furnaces, with their efficient agitation melt by the top blowing lances, have excellent heat transfer characteristics, making them ideally suited for the remelting of anode scrap and purchased copper scrap, while avoiding the associated fugitive emissions of traditional reactors like P.S. converters.

Steady state operation

“Steady State” furnace operation at constant bathline contributes to furnace integrity and simplifies refractory design. Since the bathline is constant, protection is only required for a small area to counter the “wave” motion of the melt. In contrast, all tapped furnaces require protection over a much wider area, since the bathline changes during operations. Our C-furnace bathline, will now give 3 or 4 years operation between bathline repairs, due to advances in furnace design and refractory cooling.

Simplicity of scale-up

The S and C furnaces can also be tailored to accommodate various annual production capacities. The table headed “Typical plant design parameters” on page 16, shows S and C furnace diameters for 100,000 MTPY increments in production. To move up to 200,000, 300,000, and 400,000 MTPY production levels, the furnace diameters are increased by 1 meter only. However, all Mitsubishi Process smelters currently in operation, have increased production levels by increasing oxygen enrichment, while keeping the same furnace dimensions. This clearly illustrates the simplicity of our scale-up, and underscores the compactness and high intensity of our furnaces, and our low capital cost and low operating costs.
Protecting the environment for future generations is the collective duty and top priority of our current civilization. As environmental regulations are expected to become increasingly stringent in the future, we believe the Mitsubishi Process offers its users the ability to attain the highest standards in environmental compliance, in the manufacturing of primary copper.

In a conventional smelter using P.S. converters, furnaces must be frequently blown and melts must be transferred using ladles. This causes fugitive emissions, which fill the smelter building and escape outside, to the surrounding communities. Furthermore, all reverts and ladle skulls must be crushed before they can be recycled, adding noxious dusts to an already foul workplace.

In the Mitsubishi Process, the furnaces are stationary, tightly sealed, and interconnected by enclosed launders. Small ventilation hoods placed above furnace inlets and outlets, capture all fugitive emissions. Total sulfur capture exceeds 99%, and this and efficient dust capture ensures clean conditions inside and outside the smelter, protecting the health and longevity of the workforce, and those in the surrounding community.

The recycling of scrap materials will continue to play an increasingly larger role in an ecologically responsible society. Currently many types of scraps are added to P.S. converters through their large charging ports with massive escape of toxic emissions. In contrast, the tightly enclosed Mitsubishi furnaces have been carefully modified to accept scrap materials, and still contain all furnace offgases.

For example, spent anodes from the tankhouse and purchased copper scrap can be charged and processed directly in the C-furnace, utilizing the excess heat from the continuous converting reactions. Spent anodes from the tankhouse are placed on a simple conveyor on ground level and automatically forwarded to the C-furnace roof, from where they are charged into the C-furnace through a chute fitted with double dampers to prevent fugitive emissions.

Similarly, ordinary market scraps can be pressed into blocks and charged to the C-furnace and S-furnace, using specially designed charging ports to prevent fugitive emissions. Materials, such as in-plant reverts and circuit boards can be cleanly charged through a chute in the furnace roof. Due to the efficient agitation of the melt by lances, the Mitsubishi furnaces have excellent heat transfer properties, making them ideal for scrap recycling.
COST COMPETITIVENESS

Continuous operation saves costs
Since the Mitsubishi Process always operates at or near optimum mode, there is no need to build excess capacity in main facilities like the furnaces, and ancillaries such as gas handling, oxygen and acid plants. These can all be designed very close to the smelter’s nominal capacity, greatly reducing construction and operating costs.

Just one converter is enough!
In conventional processes using batch reactors, usually three or more P.S. converters are required. The Mitsubishi Process uses just one C-furnace, which operates continuously for 40 or 50 months between battline brick repairs. In contrast, P.S. converters need tuyen line rebriking every 3 months. Thus big savings can be achieved in labor and relining costs.

Melt movement by launders reduces costs
Mitsubishi’s unique launder transportation of melts eliminates the need for ladles and large overhead cranes and their expensive support columns. The smelter building has no crane aisle, no ladle skulls storage area, and no skulls crushing facilities. Therefore, the building can be compactly designed. This and the savings on all the facilities mentioned above, results in markedly reduced capital expenditures compared with other copper smelting processes. Apart from the odd spill and some boiler accretions, there are almost no reverts to be recycled, resulting in very high overall copper and precious metals recoveries. All of the above contribute to Mitsubishi’s commendably low copper cost per pound.

Simple ventilation system
Occasionally gases escape from the furnace melt inlets and outlets. These fugitive gases contain only minor traces of SO₂, and can be vented directly to the stack, after de-dusting by bag filters. This simplifies the gas cleaning process, and greatly reduces costs.

To achieve the same in-plant environment with a conventional process, costs would be prohibitive, since the huge gas volumes captured by a roof plenum would have to be passed through a large scrubber before being released to the atmosphere.

Additional slag treatment unnecessary
Most smelters around the world charge molten slag from P.S. converters into electric furnaces, in order to recover the matte portion, and discard the slag portion. However, it is still difficult to keep copper content in discard slag low, even when magentite in slag is reduced. Therefore, some smelters in Japan have slag crushing and flotation facilities, to keep copper content in discard slag low. In contrast, slag from the Mitsubishi C-furnace can be recycled to the S-furnace without any additional treatment, and copper loss in discard slag still kept low, even while operating with a high matte grade, about 68%.

Cost reduction at the acid plant
Since a low and constant volume of gas, high in SO₂ is produced from the Mitsubishi furnaces, a compact and efficient acid plant can be designed and operated. This saves considerable power and maintenance costs, as well as reducing capital.

Low manpower requirement
Since operations are continuous and straightforward, and the three furnaces are easily patrolled by a few operators, manpower requirements are low compared to conventional processes.

The figure on page 11 compares the number of operators required for a 300,000 MTPY smelter. It makes the reasonable assumption that to maintain the same environmental quality as the Mitsubishi Process, two acid plants and complicated scrubbing facilities will be required for the conventional smelter. As can be seen, the Mitsubishi Process requires about 33% less operators than the conventional process. A considerable advantage in countries with expensive labor.

Keeping construction costs low
The graph on the left gives the approximate construction costs for Mitsubishi smelters of varying production capacities, assuming a double contact acid plant is used, and that oxygen is purchased from an adjacent supplier. The graph shows a construction cost of just under US$300 million for a 300,000 MTPY smelter, plus acid plant. This is much lower than other high temperature processing technologies. We estimate these to be anywhere from 30% to double our cost.
the training of new operators for Naoshima, and providing experienced guidance for the operators of new Mitsubishi designed smelters overseas, especially during the early stages of operation.

For example, assisted by MIOSS, LG-Nikko Copper Inc., with operators used to “Flash” technology, were able to adapt quickly to Mitsubishi Process control during their exemplary start-up at Onsan in 1998.

Similarly, at PT Smelting, Gresik, after overcoming some ancillary plant problems, the smelter has operated steadily at and above design capacity since June 2000. This outstanding accomplishment, with a locally Indonesian workforce, totally devoid of “hot metal” experience, was due to the combination of Mitsubishi’s excellent training programs, including MIOSS.

The graph on right shows production rates for the first five years at our Naoshima smelter. As can be seen, full design capacity was reached in the second year of production, and production rates have exceeded design capacity after that.

Process Reliability

Process Control

Control of the Continuous Process is like simple “pipeline” control – “inlet” conditions are measured, changes in the “middle” monitored, and the resulting “outlet” flow analyzed.

In plant practice, the matte quantity and grade is the stable “middle.” Various adjustments can be made to the S-furnace “inlet” conditions, (for example the ratio of oxygen to copper in feed). Then with constant matte entering the C-furnace, blister quality (the “outlet”) is controlled largely by holding the C-slag copper content to around 14%.

Mitsubishi's process control has developed as a fascinating combination of operator input and experience, data logging, computerized analyses, on line chemical assaying and lab support. As sensors and computers improve, the variance amongst operators becomes more significant. Therefore an “Artificial Intelligence” or “Expert System” approach was examined, similar to those developed in the Steel Industry and elsewhere. (See diagram below)

Starting in 1990, the Mitsubishi Operation Support System (“MIOSS”) was gradually developed and tested at Naoshima. It has now been used in routine operations since 1995, working from a “digitized” input of the skills and experience of the best operators, selected metallurgical data, and rapid data analyses. For any plant operating condition, it provides vocal guidance to the Control Room operator, and a printed copy on a computer screen.

Presently, just as in Chess, MIOSS cannot always out perform a “Master” operator, but it has made process control more uniform between shifts, and over extended time periods given important gains in process reliability.

MIOSS has also been invaluable in helping to speed up the training of new operators for Naoshima, and providing experienced guidance for the operators of new Mitsubishi designed smelters overseas, especially during the early stages of operation.

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TYPICAL PLANT DESIGN PARAMETERS

Typical operating parameters of The Mitsubishi Process for various copper production rates were estimated and the results are summarized as follows.

<table>
<thead>
<tr>
<th>Description</th>
<th>Unit</th>
<th>100,000MTPY</th>
<th>200,000MTPY</th>
<th>300,000MTPY</th>
<th>400,000MTPY</th>
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<tr>
<td>Conc. composition</td>
<td>%</td>
<td>31.00</td>
<td>31.00</td>
<td>31.00</td>
<td>31.00</td>
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<tr>
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<td>%</td>
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<td>Malte grade</td>
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<td>68.00</td>
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<td>Conc. feed rate</td>
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<td>84.00</td>
<td>126.00</td>
<td>168.00</td>
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<td>Silica feed rate</td>
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<td>Limestone feed rate</td>
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<td>2.6</td>
<td>3.8</td>
<td>5.1</td>
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<td>Return C-slag</td>
<td>T/H</td>
<td>3.6</td>
<td>7.1</td>
<td>10.7</td>
<td>14.3</td>
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<td>Malte production</td>
<td>T/H</td>
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<td>40.9</td>
<td>61.3</td>
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<td>Slag production</td>
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<td>49.7</td>
<td>74.5</td>
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<td>Coal feed rate</td>
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<td>T/H</td>
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<td>13,800</td>
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<td>S-total</td>
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<td>S-O2 enrichment</td>
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<td>Anode scrap feed rate</td>
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<tr>
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<td>7.1</td>
<td>10.7</td>
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<tr>
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<td>T/H</td>
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<td>30,000</td>
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<td>34.0</td>
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<tr>
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<td>2,200</td>
<td>3,600</td>
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MITSUBISHI PROCESS SMELTERS
IN OPERATION AROUND THE WORLD

- ONSAN
- NAOSHIMA
- GRESIK
- PORT KEMBLA
- KIDD CREEK
The main features of Naoshima’s operations are:

- Smelter: Mitsubishi Process
- Oxygen plant: BOC
- Casting: Sumitomo Heavy Machinery
- Tankhouse: Starter sheet type
- Acid plant: Lurgi single contact acid plant + tail gas scrubbing plant

Naoshima Smelter and Refinery is Mitsubishi Materials’ flagship smelter, and can trace its roots back to 1918 when operations first started using a reverberatory furnace. Naoshima is located in the middle of the scenic Seto Inland Sea National Park, and has strict environmental regulations.

In 1959, development of the Mitsubishi Process began, and in 1974 the first commercial scale Mitsubishi Process Smelter began operating in Naoshima with an anode production capacity of 48,000 MTPY. This was doubled to 96,000 MTPY in 1982, by increasing oxygen enrichment.

In 1991, the existing reverberatory + P.S. converter line and original Mitsubishi Process line were halted and consolidated into one new larger Mitsubishi Process line with a production capacity of 200,000 MTPY. This was subsequently increased to 240,000 MTPY one year later. In 2000, with no change to furnace dimensions, but by merely increasing oxygen enrichment, production was lifted to 270,000 MTPY.

Naoshima continues to act as a vital resource to all other Mitsubishi operations in terms of furnace design, process data, plant practice and process control.
Falconbridge Limited’s Kidd Creek Metallurgical Division is located in Timmins, Ontario, Canada. Ore is hauled from the mine to the plant site for milling and concentrating, copper smelting and refining, zinc roasting and electrowinning, and other operations.

Around 1975, Texasgulf Inc., Kidd Creek’s original owner, decided to process their copper concentrates to cathode copper. After examining several competing processes, Texasgulf selected the Mitsubishi Process for smelting and Onahama’s “jumbo tank” refining technology.

Operations started in 1981, with 60,000 MTPY production capacity. Then in 1985, with test work and design recommendations from Mitsubishi, production was progressively increased to 125,000 MTPY by oxygen enrichment.

In 2001, the Kidd smelter produced 131,000 tonnes of “new” anodes from concentrates, its highest annual production recorded to date.

A point noteworthy of mention is that in 1990, the Canadian Government issued a control order requiring that by January 1994, all smelters must reduce SO₂ emissions by at least 50%. Kidd Creek was the only copper smelting operation exempted from this control order, since Environment Canada judged the site’s control of SO₂ emissions to be more than adequate. This justified the 1975 selection and avoided the enormous refit costs required of the older smelting operations.

The main features of Kidd’s copper operations are:
— Smelter: Mitsubishi Process
— Oxygen plants: Air Products
— Casting: Hazelett twin-belt caster
— Tankhouse: Onahama Jumbo Tank + Kidd Process with stainless steel cathodes
— Acid plant: Monsanto double contact

Falconbridge Limited’s Kidd Creek Metallurgical Division is located in Timmins, Ontario, Canada. Ore is hauled from the mine to the plant site for milling and concentrating, copper smelting and refining, zinc roasting and electrowinning, and other operations.

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A point noteworthy of mention is that in 1990, the Canadian Government issued a control order requiring that by January 1994, all smelters must reduce SO₂ emissions by at least 50%. Kidd Creek was the only copper smelting operation exempted from this control order, since Environment Canada judged the site’s control of SO₂ emissions to be more than adequate. This justified the 1975 selection and avoided the enormous refit costs required of the older smelting operations.

The main features of Kidd’s copper operations are:
— Smelter: Mitsubishi Process
— Oxygen plants: Air Products
— Casting: Hazelett twin-belt caster
— Tankhouse: Onahama Jumbo Tank + Kidd Process with stainless steel cathodes
— Acid plant: Monsanto double contact

Falconbridge Limited’s Kidd Creek Metallurgical Division is located in Timmins, Ontario, Canada. Ore is hauled from the mine to the plant site for milling and concentrating, copper smelting and refining, zinc roasting and electrowinning, and other operations.

Around 1975, Texasgulf Inc., Kidd Creek’s original owner, decided to process their copper concentrates to cathode copper. After examining several competing processes, Texasgulf selected the Mitsubishi Process for smelting and Onahama’s “jumbo tank” refining technology.

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Currently LG-Nikko Copper Inc. is Korea's sole copper producer. Their Onsan smelter is located 50 km northeast of Pusan on the eastern seaboard of the Korean Peninsula. Since 1980 they have operated an Outokumpu flash smelter with three P.S. converters, and a production capacity of 140,000 MTPY. In order to meet the rising need for copper in their domestic market, they decided to expand their total production capacity to 300,000 MTPY, by installing another smelting line and tankhouse. Considering their long experience with Outokumpu flash smelting, after careful study, we were particularly pleased that they selected the Mitsubishi Process.

Their main reasons were:
1) One Mitsubishi continuous converting furnace eliminated the need for more P.S. converters. This made environmental permitting much easier.
2) Operating and construction costs were cheaper compared to other processes.
3) The Mitsubishi smelter was more compact than the existing flash smelting line.
4) Mitsubishi continuous process technology was fully proven, and much cleaner.

Major facilities adopted for the expansion at Onsan are as follows:
- Smelter: Mitsubishi Process (design capacity: 160,000 MTPY)
- Tankhouse: Kidd Process, Stainless steel cathodes
- Acid plant: Monsanto double contact type

Operations commenced on January 31, 1998. A performance guarantee test for the smelter was carried out on March 25, 1998, and successfully completed with higher than guaranteed levels. The start-up was accomplished much faster than expected, and the smelter continues to operate well above design. (e.g. In 1999, the second year of operation, 204,500 tonnes of copper was produced at an online availability of 92.3%, almost 30% over original design).

Further expansion work was conducted in 2002, to boost production of the Mitsubishi line to over 280,000 MTPY, 75% above the initial design capacity.

Onsan is the only smelter in the world, operating the Mitsubishi Process and an Outokumpu flash smelter, side by side.
PT Smelting (PTS)’s Gresik Copper Smelter and Refinery is located 30 kilometers north of the city of Surabaya, East Java’s major port. PTS’s equity partners are Mitsubishi Materials with 60.5%, PT. Freeport Indonesia with 25%, Mitsubishi Corporation with 9.5%, and Nippon Mining and Metals Co., Ltd. with 5.0%.

The entire smelter feedstock comes by ship from Freeport’s Grasberg mine on West Papua, some 2,600 kilometers to the East.

The smelter is adjacent to Petrokemia Gresik, a government owned fertilizer company, which utilizes all of the smelter’s sulfuric acid. This was a prime reason for selecting the Gresik location.

PTS began commercial production on May 28, 1999. In the calendar year 2001, PTS produced 214,000 tonnes of cathodes, 7% over design capacity. This was a most commendable achievement, considering that the locally recruited workforce started with virtually no experience of copper smelting or refining.

In June 2001, one year from the start of commercial operations, the PTS cathode received Grade “A” accreditation from the London Metal Exchange (“LME”) the “hallmark” of quality in the copper industry.

The smelter incorporates some recent improvements over previous designs including a Hazelett-Mannesmann “Contilanod” system with a casting rate of over 100 tonnes per hour. The photograph of “stacked” anodes clearly demonstrates that Contilanod produces perfectly shaped anodes, with resulting benefits to productivity and current efficiency at the refinery.

Many visitors have seen and praised the operation, however PTS’s finest accolade came from Dr. H. H. Kellogg, Professor Emeritus, Columbia University following an extensive visit in July 2000. He summarized his assessment with the words... “Truly a Plant for the 21st Century”. His full comments can be found in his letter, published in JOM, Vol. 52, No.11, November 2000.
PORT KEMBLA, Australia

Port Kembla Copper Pty. Ltd. (PKC) is located in an urban setting about 80km south of Sydney, Australia. Known formerly as Southern Copper Limited, they produced 80,000 MTPY of copper using a Noranda reactor and P.S. converters, but were forced to shutdown because of excessive fugitive emissions from the latter, and during melt transfer using ladles. Furukawa Co., Ltd. PKC’s new owner decided to replace the existing P.S. converters with one stand-alone Mitsubishi C-furnace to comply with future environmental requirements. Thus this smelter differs from the previous four, in that only the continuous converting part of the Mitsubishi Process is employed. A conceptual flow sheet of the stand-alone C-furnace is shown below.

High grade matte from the Noranda reactor is transferred by ladle car through a tightly sealed and ventilated tunnel. The ladles are then hoisted and poured into a matte holding furnace. The matte is then charged to the C-furnace at a constant rate. The continuously formed blister is siphoned and conveyed to anode furnaces via launders. Operations started in 2000, and the smelter can produce around 120,000 MTPY of copper.
The Mitsubishi Group
By the early 1940’s, the original Mitsubishi zaibatsu (Mitsubishi Company), founded in the early 1870’s, had expanded into virtually every sector of the economy, including mining, heavy industry, oil refining, chemicals, banking, trading, real estate, insurance, even aircraft manufacture. It was the biggest most powerful industrial combine in pre-war Japan.

Then, with the advent of World War II, everything changed. After the war, the single organization was dissolved into scores of independent companies that were no longer subject to central control.

The common misconception abroad however, is that Mitsubishi is still one giant company. This is not so. It is a collection of dozens of autonomous companies. Some of them have been around for more than a century, while others have grown up in the last few years.

Mitsubishi Materials Corporation
Mitsubishi Materials Corporation was created on December 1st, 1990 by the merger of Mitsubishi Metal Corporation and Mitsubishi Mining and Cement Co., Ltd. which had been established after World War II by the allied breakup of the old Mitsubishi Mining Company. Mitsubishi Materials Corporation is one of the world’s largest materials companies, employing more than 25,000 people in 19 countries. The company has built strong positions in metal smelting and refining, cement manufacturing and metal fabricating, and is now also regarded as a technical leader in areas such as silicon wafer, electronic components and advanced materials.

Significant dates
1871 Mitsubishi Company established.
1896 Start of metal smelting in Osaka Refinery following transfer from the government.
1917 Naoshima Smelter established as the central smelter of Mitsubishi by Mitsubishi Company.
1918 Mitsubishi Mining Co., Ltd. established as off-shoot of the Mitsubishi Company metal and coal mining division. Naoshima Smelter started operation of a reverberatory furnace.
1950 Post World War II, allied break-up of Mitsubishi Mining Co., Ltd.
1990 Merger between Mitsubishi Metal Corporation and Mitsubishi Mining and Cement Co., Ltd. to form Mitsubishi Materials Corporation.
1992 The completion of the new headquarters building (Otemachi First Square) in Otemachi.

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Mitsubishi Materials Corporation, as a nonferrous metal producer maintaining a long history of highly advanced technology, and undertaking a diverse range of activities worldwide, can provide all or part of the following services upon your request.

1. Feasibility studies
2. Test work
3. Licensing
4. Basic engineering
5. Detailed engineering
6. Training
7. Start-up assistance
8. Supervision of plant erection and construction work
9. Supply of machinery, equipment, and facilities
10. Guidance during early operating years

Head office(Otemachi First Square West)