

# metals & mining

The magazine for the metals and mining industries

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**SIEMENS**  
**V A I** 

IS'06 – Impulse Next Generation Metals

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## Dear Reader,

Whenever one company acquires another, there are always questions, questions like "What can each company contribute toward the combined business?" or "Where are there overlaps?"

Questions such as these were also raised in July 2005, when Siemens acquired VAI (Voest-Alpine Industrieanlagenbau) of Linz, Austria and initiated measures to merge the metallurgy business of both enterprises. The competencies of both companies compliment one another. Today, the new combined business operates worldwide under the name of Siemens VAI Metals Technologies – a name that holds much more than Siemens and VAI could have offered individually. Together, we are setting standards of innovation in the metals industry. As a single-source provider, we deliver products, systems and services to support every step of the entire production cycle – for everything from ore mining to iron and steel production.

Siemens brought its new spectrum of electronic products and automation solutions into the portfolio mix. VAI contributed global plant solutions for iron & steelmaking with such names as VAI Fuchs (EAF and electric steel plants), VAI Pomini (mini mill and long-product plants), VAI UK (blast furnaces) as well as VAI Linz (Corex and Finex plants, LD converters, environmental technologies, casters, turnkey competence). In the area of rolling & processing, there is VAI Clecim and VAI Cosim (processing lines/cold mills and strip-finishing lines), VAI UK (plate mills, aluminum, stainless steel), VAI Linz (hot and cold mills) and Siemens (electronics and automation).

Siemens Metals Technologies comprises all of these leading technologies and best process know-how for every aspect of iron and steel production, along with the combined experience of some 7,500 employees overseeing an installed base located around the world. Unlike any other company, we are in a position to develop and offer new technologies through the combination of innovative electrical engineering and mechatronic solutions.

Capabilities and competencies that only exist in the ivory tower of the corporate boardroom are of little use. They must be delivered to the customer. Here, a globally positioned enterprise such as Siemens can offer new opportunities. With branch offices in over 190 countries, we benefit from our local presence and customer proximity – around the clock. This is a key factor for our ability to offer customers optimized service support – everything from "operational support" and maintenance services to bigger challenges such as "plant modernization and optimization."

We want to move forward on these issues, and will therefore report on them regularly in **metals & mining**. Thus, special articles on these topics are also understood as an invitation for dialogue. Only by pulling together are we able to continue down the successful path on which we have embarked with Siemens VAI Metals Technologies.

Dr. Richard Pfeiffer  
**President and chairman of the board  
 Siemens VAI**

## New Steel Plant for ThyssenKrupp

Siemens VAI received an order from ThyssenKrupp CSA Companhia Siderúrgica for the supply of an LD (BOF) converter steelmaking plant and two slab casters for a new integrated iron and steel works to be built in Brazil. The start-up of the plants is scheduled for early 2009. For the new steel mill, Siemens VAI will supply two LD (BOF) converters with a capacity of 330 tons each, two secondary metallurgical facilities, one primary and one secondary dedusting system as well as two slab casters, including the associated electrical and automation systems. ■

## First Gearless Mill Drive System

For the first time ever, a Brazilian mine is set to receive a Siemens gearless mill drive system. The Siemens Industrial Solutions and Services Group (I&S) will equip the mill belonging to the Rio Paracatu Mineração mining company with this technology. The "Simine Mill GD" drive technology has no mechanical wear parts and, therefore, significantly lower maintenance requirements than conventional mill drives. Stepless adjustment of the rotational speed allows more efficient and more energy-saving milling of ore than was previously possible. The order is worth around EUR 9 million. ■



## Tandem Cold Mill and Hot-Dip Galvanizing Line for Corus

Siemens was awarded a contract by the Corus Group to supply a new tandem cold mill, which will be coupled with an existing pickling line, and a new hot-dip galvanizing line for the company's plant in IJmuiden, The Netherlands. Corus will utilize the new installations to further expand its product range capabilities for the automotive and construction industries, including the production of advanced high-strength steels (AHSS). The new plant is scheduled to start production in mid-2008. Corus and Siemens closely worked together on the design of the new plants, with Corus placing special demand on the reliable start-up of the new installations and on long-term protection of its investment. Decisive factors among the reasons for the contract being awarded to Siemens included the company's technical and technological competence, its numerous plant references in this field and the security provided by competent long-term support from Siemens. ■

## Booming Steel Market in Saudi Arabia

Siemens VAI received an order from Atoun Steel Industry Co. (ASi) for the supply and installation of all of the process equipment for a new minimill to be built at Yanbu, Saudi Arabia. Following a construction period of two years, the plant will be capable of producing a total of close to one million tons of liquid steel as well as half a million tons of reinforcement bars and rounds per year for the booming local construction industry. For this major steel project, Siemens VAI will supply all process equipment from the scrap yard to the rolling mill. The order volume amounts to more than EUR 100 million. ■

# Plant Start-ups (October to December 2006)

Customer	Country	Project
AHMSA	Mexico	Start-up of VAiron blast-furnace process optimization system
Arcelor Bremen	Germany	Tandem cold mill modernization of rollchange system
Beitai Iron and Steel Works	China	120-t vacuum degassing plant
Bluescope Steel	Thailand	Scalebreaker for pickling line
China Shougang International Trade & Engineering Corp.	China	2-strand slab caster equipped with the latest technological packages to enable a slab production of approximately 2.2 million t/a comprising low to high carbon, alloyed, structural, HSLA and deep-drawing steel grades
Corus Ijmuiden	The Netherlands	Modification of machine head of 2-strand slab caster in which curved mold design was replaced by straight mold design to improve internal cleanliness of steel
Corus	The Netherlands	Hot strip mill, modernization roughing mill automation
Corus	UK	Rail-finishing line, including pre-cambering, cooling and handling facilities
Georgsmarienhütte	Germany	Process optimization for secondary metallurgical plants
Ijitsch Metallurgical Combine	Ukraine	1-strand slab caster equipped with the latest technological packages to enable a slab production of approximately 1 million t/a comprising carbon, peritectic, HSLA and micro-alloyed steel grades
Iskenderun	Turkey	Start-up of VAiron blast-furnace process optimization system
Jindal South West Steel Ltd.	India	1-strand slab caster equipped with the latest Siemens VAI technological packages to enable a slab production of approximately 1 million t/a comprising carbon, peritectic, HSLA low-alloyed and micro-alloyed steel grades
MK Kremikovzi AG	Bulgaria	1-strand slab caster
Nippon Steel Corporation	Japan	Blooming mill, new AC motor with voltage source converter
N.T.S. Steel Group	Thailand	Upgraded bar- and wire-rod line
Salzgitter Flachstahl AG	Germany	Cold mill, modernization of automation
Shagang	China	New plate mill
Shanghai Baosteel Group Corporation	China	New bar mill for production of high-alloyed steel grades
Sheffield Steel	USA	Automation and process optimization for ladle furnace
Shougang	China	New plate mill, electric and automation
Taiyuan Iron & Steel Co.	China	Stainless steelmaking plant comprising two 160-t electric arc furnaces, two 180-t AOD (argon oxygen decarburization) converters, a twin-station ladle furnace and two single-strand slab casters
Tianjin Pipe Corporation Ltd.	China	100-t vacuum oxygen degassing plant and upgraded 6-strand stainless-steel round-billet caster
voestalpine Stahl	Austria	Automation and process optimization for ladle furnace and RH degassing plant
Wuhan Iron and Steel Co.	China	New continuous annealing line, electric and automation



IS'06 – Siemens VAI's Iron and Steelmaking Conference, October 2006

# The Steel World Meets in Linz

One of those great events in the world of iron and steelmaking took place in Linz, Austria from October 9–11, 2006. Under the motto of "Impulse Next Generation Metals," over 550 specialists from more than 50 countries met to participate in the IS'06 – the first combined iron and steelmaking conference of Siemens VAI.

COVER STORY >





## Newton's cradle

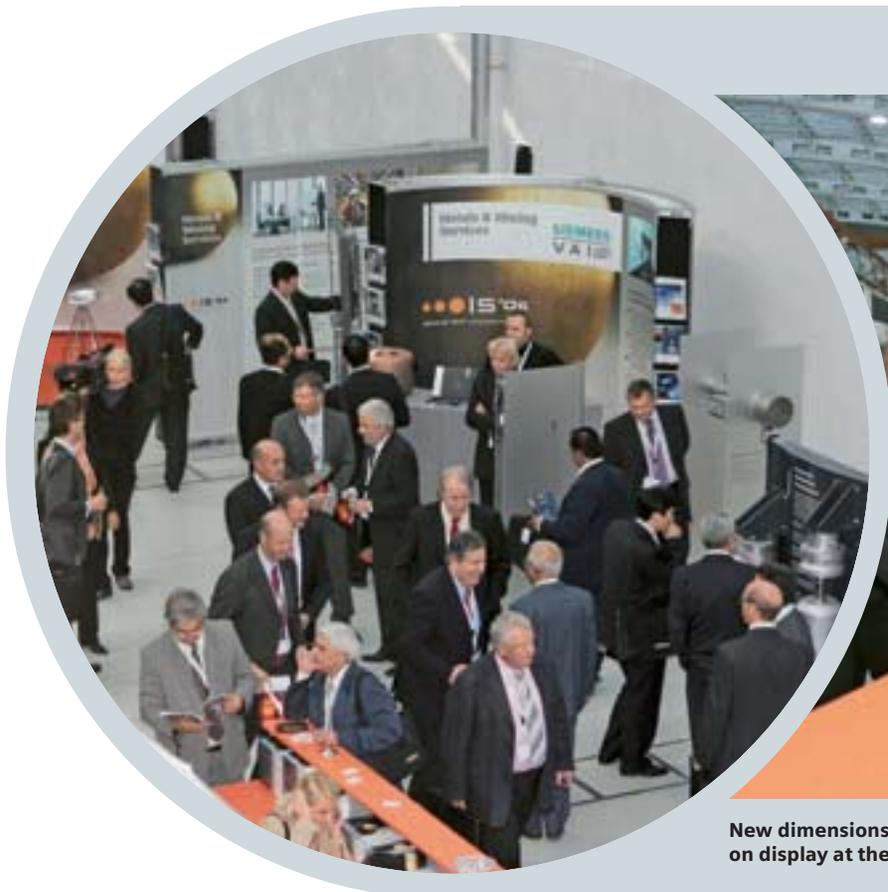
The symbolic theme which accompanied the conference was the image of the well-known Newton's cradle. As described by the English universalist Sir Isaac Newton (1642–1727), when a moving steel ball strikes the first of a series of steel balls lined up in a row, the impulse is transmitted in a chain reaction to all of the other balls until the final steel ball flies off in an arc. And in the same way – with consideration to the conference motto "Impulse Next Generation Metals" – it is our conviction that the impulse of an idea can also result in a chain reaction which leads to the generation of new ideas that can have a major impact on the iron and steel industry.

It was very appropriate that the IS'06 took place in Linz, "the Steel City of Austria," – site of the world's first implementation of the LD (BOF) oxygen steel-making process by VOEST (now voestalpine AG) in 1952. Linz is also the headquarters of Siemens VAI Metals Technologies, formerly VOEST-ALPINE Industrieanlagenbau (VAI). The timing of the conference was also not by chance. The year 2006 is a jubilee year, marking the 50th anniversary of the founding of VAI (originally an internal division of VOEST known as "Werksausbau") in 1956, coinciding with the signing of a contract for the supply of an LD (BOF) steel plant to Rourkela, India. This was the ambitious start of the international victory march of the oxygen steelmaking process, which now accounts for 62 % of all of the

steel produced worldwide. It was also the starting shot for the emergence and growth of Siemens VAI to its position today as the world's leading supplier of metallurgical plants for the iron and steel industry.

### Technology focus

A total of 72 lectures were held during the IS'06 in twelve dedicated sessions and in six workshops on the topics of ironmaking, steelmaking, minimill technologies, plant start-ups, operations, equipment design, automation, modernization, maintenance and services. The workshop sessions also served as a platform for intensive technical discussions focusing on improvements related to plant productivity, product quality, costs and environmental matters. Mr. R. Baan (exec- >>



**New dimensions in iron- and steelmaking technology on display at the IS'06**

>> utive vice president and management committee member of Arcelor Mittal) served as the honorary chairman and held the keynote address under the title “Trends, Market and Development in the Iron & Steel Industry.”

The IS’06 event was accompanied by a major exhibition at which Siemens VAI highlights from the iron-making, steelmaking, minimill, service and automation sectors were on display. This included five information booths, physical models, “hands-on” 3D simulators, interactive games, quizzes and much more.

**Ironmaking**

Numerous papers dealing with various aspects of raw material preparation and ironmaking were presented at the IS’06. Innovation highlights included the worldwide launch of the new gimbal top-charging system for improved productivity in ironmaking vessels, the status of Corex and Finex technology, the Hot-DRI transport system as well as the eposint and Meros environmental solutions for sinter plants.

An 18-t, 13-m-high, fully operational Gimbal Top® distributor underlined the simplicity and the unique performance of this equipment. A 3D visualization of

the Finex 1.5M plant in Korea and of a typical minimill could be viewed on the computer through the perspective of a bird’s eye view.

**Steelmaking**

During the steelmaking sessions, the latest advances in EAF and LD (BOF) steelmaking were covered. As the centerpiece of technological development in electric steelmaking, features and benefits of the ultimate series of high-performance EAFs were emphasized. In the field of oxygen steelmaking, the application of technology packages showed how converter performance can be boosted and optimized. The latest project successes in stainless steel meltshop installations were also outlined. Recent developments in environmental technologies showed that steelmaking today is possible at lowest emission rates and with a high degree of recycling.

**Automation**

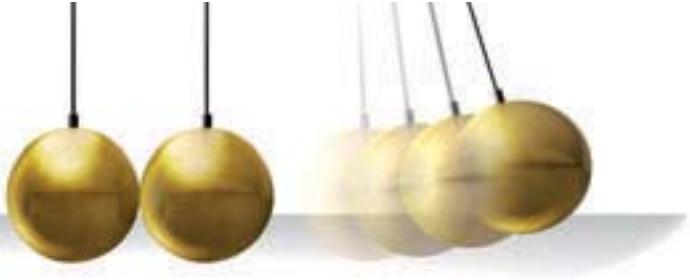
Through the merger of VAI and Siemens, the entire spectrum of electric and automation solutions can now be supplied from a single source. Recent developments in the field of process optimization and techno-



Welcome address by Dr. Richard Pfeiffer, president of Siemens VAI Metals Technologies



Opening of the exhibition, (l to r): R. Pfeiffer (Siemens VAI), J. Haslestad (Siemens AG), R. Baan (Mittal Steel Co.), K. Schwaha (Siemens VAI), K. Gruber (Siemens VAI)



logical control systems are a further step in the direction of fully automatic iron- and steelmaking plants, and support the cost-efficient production of hot metal and quality steel. Dynamic control of the complete iron-making, steelmaking and secondary metallurgy processes is now possible. Innovations in this field are based on metallurgical and technological know-how, and on state-of-the-art electrical and automation technology. For example, already more than 10% of the world's hot metal produced in the blast furnace is supported by VAiron automation and process-optimization systems.

#### Metals & Mining Services

Siemens VAI Metals & Mining presented highlights of their numerous spare parts and upgrading activities: The automatic gas-coupling system for stirring gas connections and its important contribution to personnel safety in steel plants. Two models of this innovative

system were on display in the exhibition. Another highlight was the Siemens VAI Lomas gas-analyzing system, which provides immediate analysis of the converter off-gas for optimum process control in LD (BOF) steel-making. Considerable interest was shown by the IS'06 participants in the scope of the life-cycle solutions and services offered by the Siemens VAI Metals and Mining service department.

#### Social events

In order to promote the social contact and friendship amongst the members of Siemens VAI's ironmaking and steelmaking family, an attractive social program was organized. This included the traditional river boat trip on the Danube River in addition to a breathtaking show of Austrian customs and traditions. For the accompanying guests, an unforgettable tour to the famous Upper Austrian Lake Area and to Salzburg ("The City of Mozart") was organized. ■

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Austrian culture at its best!



IS'06 showcases innovation at Siemens VAI

# A Display of Competence

Held recently at the Siemens VAI Design Center in Linz, Austria, the IS'06 Conference featured more than 70 papers delivered by steel producers and Siemens VAI technologists on advanced iron and steel production, innovative developments, modernization, automation, environmental solutions, training, service aspects and other highlights.

COVER STORY >



**A**t the IS'06 Conference, papers on ironmaking, steelmaking, innovations, and the environment were accompanied by workshops covering these individual topics. This gave visitors the chance to select thematic highlights for further exploration.

#### **Gimbal Top out front**

Placed directly in front of the doors of the conference center, a demonstration installation of the Gimbal Top® furnace-charging system (see pages 13–15) greeted visitors entering the Linz Design Center. Siemens VAI has been involved in the design of blast furnaces and furnace top charging systems for over 100 years. In fact, when the bell-less top technology was first developed in the early 1970s, Siemens VAI was among the first blast furnace designers to embrace this technology. Since then, Siemens VAI has designed and installed this type of charging system on both new and rebuilt furnaces.

#### **Moving Corex into the mainstream**

The Corex® process has proven to be an economical and environmentally friendly alternative to conventional blast furnace technology. On the basis of the design and installation of four operating Corex plants, in addition to the first Corex C-3000 plant currently under construction at Baosteel (see pages 24–25), Siemens VAI has accumulated a wealth of experience in engineering and operations. Environmentally friendly production of hot metal and lower dependency on metallurgical coal or externally sourced energies such as natural gas is helping the Siemens VAI Corex process to capture an increasing share of hot metal production worldwide.

#### **Finex – from fine ore to hot metal**

Finex® is an innovative new process for hot metal production based on the direct use of fine ore and non-

**“The success of Corex at JSW indicates a bright future for smelting reduction processes. JSW Steel has carried out a number of developments within a short span of operation, and is constantly striving for further improvements”**

**Tapan Kumar Naha, JSW Steel Limited, India**



#### **At the forefront of sintering technology**

Conference participants also learned about the latest design features and solutions for high-performance sinter plants. Siemens VAI sintering technology achieves consistently high sinter quality to ensure stable hot metal quality at the blast furnace.

Dragon Steel Corporation (DSC) of Taiwan recently awarded Siemens VAI a contract for the design and supply of a new sinter plant, with the start-up scheduled for December 2009. With the Siemens VAI design, especially with respect to raw mix preparation, sinter machine charging, pallet cars, sinter cooler and waste-gas treatment for DSC sinter plant no. 1, a new milestone will be achieved in terms of operational efficiency and environmental protection. In particular, the selective waste-gas recirculation system enables operation of the exhaust gas cleaning facilities with a minimum off-gas volume, thus cutting operation costs.

coking coal. The key plant sections are fluidized bed reactors for the reduction of fine ore to DRI and a melter gasifier for the melting of DRI to hot metal. With Finex, cokemaking and sintering of fine ore can be avoided compared to the conventional blast furnace route. The quality of the hot metal is equal to that of the blast furnace or Corex hot metal.

The Finex technology has been jointly developed by Posco, Korea and Siemens VAI since 1992. The first commercial Finex 1.5M plant for the production of 1.5 million t/a of hot metal will commence operations at Posco's Pohang Works in April 2007.

#### **The latest in LD converter steelmaking**

Siemens VAI also presented the latest developments and trends in LD converter steelmaking. The LD (BOF) process is characterized by rapid changes of temperature and chemical analysis of the steel bath dur- >>

>> ing oxygen blowing and inert gas stirring, which are not directly accessible for continuous measurement. Experience gained in more than 25 years of oxygen steelmaking optimization has enabled Siemens VAI to develop innovative solutions based solely on physical and chemical principles. This enables the imaging of the overall LD (BOF) process with remarkable accuracy.

The new process models are no longer based solely on the equilibrium calculation at blowing end, but rather on a dynamic calculation throughout the complete LD steelmaking process. This allows the effect of different blowing, stirring or material addition patterns on the process to be taken fully into account.

**New LORA, VAI-Q and LIBS software**

The IS'06 Conference took a detailed look at the challenges involved in the automation of the steelmak-



**Gimbal Top out front**

ing process. Siemens VAI introduced new software and technological packages for logistics, quality control and slag management.

LORA (logistic optimizing & routing algorithm) is a logistics package for the simulation of production. The LORA simulation program was created by Siemens VAI to optimize layouts involving production-related parameters.

Siemens VAI-Q Steel guides operators interactively through the dynamic steelmaking and refining processes. This enables better quality planning, quality control and quality feedback using rule-based steelmaking instructions. Siemens VAI-Q Steel is fully integrated into the Siemens VAI process computer, and provides solutions for various aggregate types in the melt shop.

LIBS (laser-induced breakdown spectroscopy) analyzes slag composition for automatic slag disposition. The LIBS system, which is already well-known among steel analysts, has now been applied to slag analysis



in order to obtain information about the free lime content of LD slags that is essential for a saleable slag product. With LIBS, this information can be obtained in seconds.

A further option of the slag analysis is a feedback to the metallurgical LD process in order to tune LD model parameters. The measuring system is currently being tested on liquid samples. Ultimately, the system will be installed in the steel shop and operate under actual steelmaking conditions.

**Ultimate EAF**

Siemens VAI Fuchs took advantage of the conference venue to present a new generation of electric arc furnaces called Ultimate. Combining all advanced tech-



**A DVD containing the lecture proceedings of the IS'06, including pictures and a movie clip taken at the conference, can be ordered at [smeltingreduction.metals@siemens.com](mailto:smeltingreduction.metals@siemens.com)**

nologies that are included in the product range of Siemens VAI Fuchs (such as ultra-high power input, the latest oxygen- and carbon-injection technologies and special design features including ultra-high shell design and strong, simple and reliable mill components), an electrical arc furnace is capable of producing approximately 1.8 million t/a with a tapping weight of 120 t and achieving a tap-to-tap time down to 30 minutes. All auxiliary equipment (transfer cars, ladles, preheaters, cranes) as well as the design of the plant, stays in a standard size range.

Visitors from more than 50 countries spent two days reviewing these technological highlights at the Linz Design Center. ■

**More Information**  
[www.siemens-vai.com/is06](http://www.siemens-vai.com/is06)  
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Drawing on their extensive experience of furnace top charging systems, experts at Siemens VAI continuously strive to develop next generation material distribution systems designed to improve process control, enhance blast furnace performance and reduce downtimes during scheduled maintenances. If a savings of only one day of downtime per year can be achieved, this alone potentially results in an additional production output of up to 10,000 tons. This insight, along with a number of other potential benefits, inspired design engineers at Siemens VAI to create the Gimbal Top®.

**Spotlight:  
the Gimbal Top distribution system**

## Ultimate Flexibility

**A**s part of the new, more advanced Corex® process technology of Siemens VAI, design engineers identified a need to accurately distribute coal over the top surface of the melter gasifier. The resulting so-called “gimbal” technology has now been successfully installed at the Corex plants of Mittal Saldanha Bay in South Africa and at POSCO in South Korea. Two more units are currently scheduled for installation at Baosteel in China by 2007.

The atmosphere inside of the Corex vessel is more extreme than that inside of a blast furnace. Similarly, the operating parameters of the gimbal for the Corex process are also much more severe in terms of temperature and pressure. The normal operating temperature hovers at around 1,000 °C, and at a pressure of up to 5 bar g.

As a result, applying gimbal technology to a blast furnace was a natural development. The gimbal sys-



tem offers a simple, elegant, rugged, highly competitive design that is very well suited for high-temperature and high-pressure operation. It offers a number of significant advantages over conventional designs.

### **Blast furnace charging**

The Gimbal Top distribution system developed by Siemens VAI is designed to facilitate the controlled distribution of feed material entering the blast furnace with the help of a gimbal-controlled distribution chute. The feed material passes through a holding hopper and variable material gate, opening in such a way so as to allow the charging system above to operate independently of the distribution system.

Taking a look back some 40 years, furnace charging was handled by a series of so-called “bells.” A wide number of advanced bell-charging systems were available that enabled relatively independent move- >>



>> ment to achieve the necessary pressure sealing and material distribution in the furnace.

The “bell-less” top featured an open-top charging chute capable of both rotation and tilt movement driven by a complex train of precision gears. Bell-less top technology has been the dominant form of blast furnace charging technology for more than 30 years.

#### Infinite charging options

The new Gimbal Top utilizes a conical distribution chute which is supported by rings in a gimbal arrangement, thereby enabling independent and combined tilt movement of the chute axis.

The tilting chute is driven by two hydraulic cylinders mounted apart from one another at a 90° angle. This type of suspension and drive arrangement does not result in a rotation of the tilting chute, but rather allows for a circular path through the combination of both tilting motions.

Through either independent or combined operation of the cylinders, the chute axis can be directed at any angle or along any path. Linear position transducers are fitted to both hydraulic cylinders, thus controlling each stroke by means of a feedback control loop. The innovative design enables greatly improved and precise material distribution to the blast furnace, along with the option for an infinite number of charging patterns.

Axis movement is achieved with the help of two hydraulic cylinders, each operating through a shaft, connecting rod and universal joint in order to drive the gimbal rings. Through the movement of the hydraulic cylinders, the distribution chute ensures precise material distribution, potentially allowing an infinite number of charging patterns at varying speeds. Charging patterns options include ring, spiral, center, spot, segment or sector charging, while also offering complete control of material charging into the furnace.

The key features of the Gimbal Top are:

- Simple, rugged design
- Drive cylinders are mounted outside the pressure envelope; thus, they are not subject to hot and dusty service conditions
- The gimbal ring design allows for a simple tilting motion in two planes, providing 360° charge material distribution

- Wear on the tilting chute is evenly distributed around its circumference, ensuring a long extended operational life

#### Operational advantages

Used in rugged Corex applications, the Gimbal Top has earned its merits in high-temperature and high-pressure operation on numerous occasions. The operational advantages of a charging system that utilizes a distribution chute and lock hopper have already proven themselves at blast furnaces around the world. The Gimbal Top enables a similar charging philosophy to be followed while opening the path for yet further charging improvement possibilities.

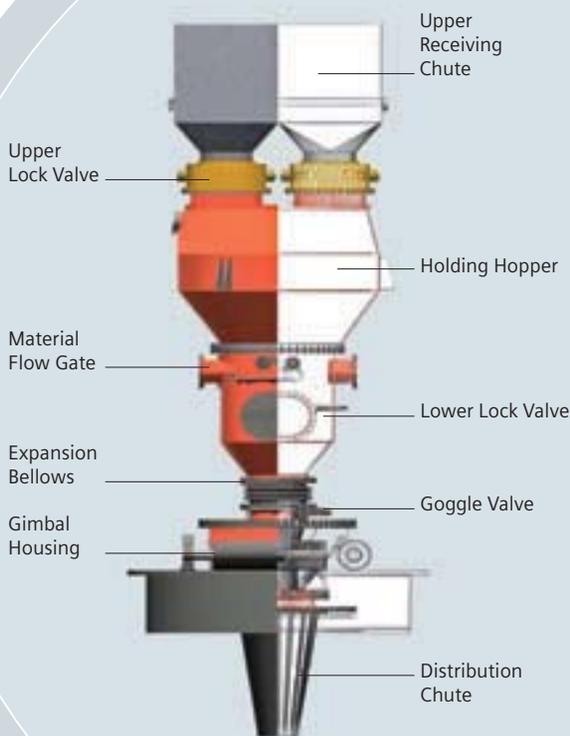
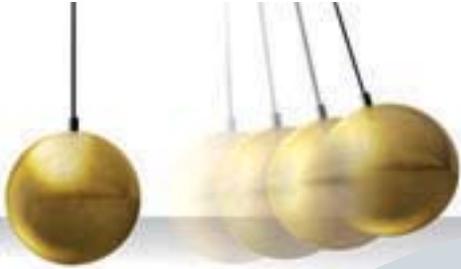
The principle operational advantages of improved material distribution by chute and lock hopper system are as follows:

- The blast furnace can be optimized in terms of fuel rate
- Coke rates decrease by up to 20 kg/t compared to bell systems
- Fuel injection rates can be increased from 100 kg/t (PCI equivalent) to 200 kg/t, assuming good material properties. This offers the potential for replacing 100 kg/t of expensive coke with cheap coal or natural gas
- Improvement in fuel injection allows for increases in blast temperature, oxygen enrichment and, therefore, a production increase of approximately 10 %
- Cheaper maintenance, avoiding long shutdowns for bell changes

#### Engineering advantages

Compared to other solutions, the robust simplicity of the Gimbal Top system also offers numerous engineering advantages:

- Simple lever mechanisms allow the drive cylinders to be mounted outside the pressure envelope. As a result, they are not subject to hot and dusty service conditions
- Distribution chute liners wear at an even rate around the full inner surface, since the material flows over the full periphery of the chute. This prolongs the wear life – a life of 5 years is predicted for the distribution chute
- The use of high-precision gears is not necessary
- The Gimbal Top mechanism is uniquely cooled with water on a closed-circuit cooling system. The closed circuit reduces the potential for water leakage into the furnace, utilizing low volume high pressure leak detection
- The bearings on the Gimbal Top assembly itself are sealed for life
- Twin linear motion produces infinite movement variations



## Gimbal Top design at a glance

### Upper receiving chute

A chute that takes up the charge material from the stock house and directs the flow into the holding hopper below

### Upper lock valve

A hydraulically-operated valve at the top of the holding hopper which opens to allow the charging material to enter the hopper, and then closes to allow hopper pressurization

### Holding hopper

The holding hopper collects the charge material from the stock house via the upper receiving chute. Connected to the furnace top equalizing and relief system, the hopper is pressurized for efficient charging, and also seals/vents for refilling

### Material flow gate

A hydraulically operated flow gate at the base of the holding hopper opens to allow a controlled flow of material from the hopper to the gimbal distributor

### Lower lock valve

A hydraulically operated valve located beneath the hopper and material flow gate which opens to allow material discharging from the flow gate to enter the gimbal distributor, and closes to seal the hopper from the furnace top pressure

### Expansion bellows

These allow relative movement and thermal expansion between the Gimbal Top distribution housing (mounted on the furnace top cone) and the holding hopper/valve housing (mounted on the support structure)

### Goggle valve

A hydraulically operated valve isolating the gimbal valve housing and holding hopper from the furnace itself during maintenance activities

### Gimbal housing and distribution chute

The housing contains a fixed inlet chute and a tilting distribution chute supported by rings in a gimbal arrangement, thereby allowing independent and combined tilting of the chute axis

## Exciting addition

After successful application in arduous high-temperature and high-pressure environments of the Corex melter gasifier, the rugged design of the Gimbal Top charging system is certain to offer an exciting addition to the world-class blast furnace technologies portfolio of Siemens VAI. The innovative gimbal design allows for an infinite number of charging possibilities, while the rugged simplicity of the drive provides an efficient solution at minimal investment. As part of the overall furnace top charging system, the Gimbal Top distributor provides a fully-integrated charging solution that offers significant improvements in blast furnace operation and maintenance cost reduction.

## Outlook

Siemens VAI is currently developing two standardized versions of the Gimbal Top distribution units for mid-to large-scale blast furnaces. The units are designed for installation at new blast furnaces, and are also suitable for retrofits to existing blast furnace installations. ■

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Innovative gearless drive technology from Siemens

# The Drive Behind Convenient Grinding Mill Operation

The first gearless drive for a grinding mill of a mining plant was installed in 1979 in the iron ore concentrator of Sydvaranger in Kirkenes, Norway. Today, about 50 gearless drives are in operation in the mining industry, driving grinding mills from 21' to 40' ID in a power range from 5,000 to 30,000 hp. The variable speed of the gearless drive is used to adjust the mill speed to the requirements of the grinding process, but also to provide low-speed operation for positioning of the mill during liner maintenance.

**T**oday's state-of-the-art electronic control allows easy operation of the mill with the gearless drive. The HMIs are conventional operation panels as well as operator workstations. Operation control is located in a place, where it is convenient for the operator. The local control panel of the mill's lubrication system (LP), for example, is located near the lubrication system itself and used mainly for maintenance of the lubrication system of the mill's bearings. The local control panel of the mill drive (MLCP) is located near the mill, where the operator can observe mill and motor directly and verify the results of his actions. The creeping panel (CP) is a small transportable hand panel for local operation and detailed inspection, as well as for maintenance purposes. It is stored in a cabinet, when it is not used. The central control room (CCR) of the plant houses the computer type HMI to operate the mill remotely.

### Starting and stopping

Normal operation is done locally at the MLCP or remotely in the CCR. For local operation, the operator in the CCR must give authorization. Once operating in local mode, the CCR can only operate with local permission. On the MLCP, the operator starts the auxiliaries of the mill and drive. With all interlocks fulfilled, the PLC signals that the mill is ready for operation. The operator now starts the mill with one push of the button on the MLCP. The gearless drive control applies the same speed ramp and accelerates the mill to the selected speed. During each start, the gearless drive control verifies whether there is a frozen charge, and switches the mill off, if this is the case.

To stop, the operator presses the stop button on the MLCP. The gearless drive decelerates the mill over a speed ramp to zero. When the speed reaches zero, the charge of the mill is still unbalanced. The mill would oscillate if simply switched off at that instant. The oscillation can last up to 20 minutes, because the only fric-

tion in a gearless driven mill is the charge itself and the friction of the bearing's oil film. To avoid such oscillation, the gearless drive changes the direction of rotation and turns the mill back until the charge is balanced.

### Inching toward the correct position

Inching is an operation mode for the positioning of the mill to gain access to liners for exchange. It is done at a speed of 1.2 rpm. Since it is a maintenance mode of the mill, inching is operated locally from the MLCP. The operator indicates the angle to be turned on the MLCP (inching angle). To ease the selection of the turning angle, the selection is based on the number of bolts around the circumference that the mill is to be turned. Inching starts and stops with a balanced mill charge and with the brake open.

The gearless drive turns the mill and lifts the material. The angle at which the material cascades the first time is measured and stored. The drive turns the mill by the requested angle, and then overturns the mill by the cascading angle. Upon reaching the sum of requested and cascading angle, the drive stops the mill and changes the direction of rotation. The gearless drive turns the mill back by the cascading angle, switching over to torque control. It turns the torque-controlled mill back until the torque is zero. With the torque at zero, the charge is balanced and there are no oscillations. The brake is open.

### Main Benefits

- Easy-to-manage operation modes
- Less mill drive downtime
- Increased mill availability through Frozen Charge Shaker
- Enhanced safety through Frozen Charge Protection

### Creeping with and without brake

The creeping mode has the same application as the inching mode, namely to position the mill to a certain angle for liner change. During inching mode, the mill operates at a low speed of 1.2 rpm. This is about 10 % of the normal operating speed, but still too fast to follow the mill with the eyes and to position the mill with start/stop signals.

Creeping is performed at a speed of 0.3 rpm, slow enough to turn the mill manually to a certain position. For the creeping mode, a separate handheld creeping panel (CP) is used.

Creeping with the brake involves the gearless drive starts turning, and first lifts the charge. While the mill is running, the operator observes the liners coming out of the charge. When the requested liners come out, he stops the mill releasing the push button of the CP. The gearless drive stops immediately, providing the necessary torque to the mill. Then its PLC closes the brake and shuts off the motor. The creeping operation is also pos-

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**Grinding mill: about 50 gearless drives are in operation in the mining industry**



>> sible without applying the brake. This makes it possible to use this operation mode also if the mill has no brake or a brake of low capacity.

At the beginning, the procedure is the same as that with the brake. But when the operator releases the run button, the gearless drive turns the mill automatically back to a balanced position. This version of creeping is less convenient and more time consuming than creeping with the brake, because restart has to be performed from the balanced position, and the material must be lifted to the cascading angle first before the charge inside the mill starts to move.

#### **Protection against frozen charge damage**

Depending on the content of fines, the mill charge can solidify during a standstill and the solidified charge can stick to the mill body. This effect is called “frozen charge” and can damage the mill, if the solidified charge is lifted during start and falls from the upper part of the mill. The frozen charge protection feature measures the torque of the charge, and verifies during each start whether the charge has cascaded. If it has not cascaded before reaching an angle of 85°, it switches the drive off and lets the mill oscillate. This procedure loosens the solidified charge from the mill body.

But often it is not enough to switch the drive off and let the mill oscillate. The charge remains solidified and stuck to the mill body. Repeated starts of the mill and trips by the frozen charge protection may help to remove the stuck charge, but often it is necessary to apply mechanical means to solve the problem. In the worst case, jack hammers and shovels are necessary to remove the solidified charge from the mill.

Siemens has developed and patented an operation mode for the gearless drive called the Frozen Charge

Shaker™, which helps to break up the solidified charge and to loosen it from the mill body. The Frozen Charge Shaker can be operated from the MLCP. The operator must be authorized to perform this exceptional operation, and a key-operated switch has been installed in the MLCP for this operation mode.

When the start button is pressed, the gearless drive turns the mill, lifts the charge up to the maximum safe angle for the mill, and moves the mill up and down. It then returns the mill to the balanced position, lifts the charge on the other side up to the maximum safe angle, and again moves the mill up and down.

The automatic Frozen Charge Shaker operation is now finished. The operator can verify whether there is still a solidified charge by starting the mill in any of the operation modes. The total time for breaking a solidified charge with the Frozen Charge Shaker, including preparation and a test run afterwards, is estimated to be 30 minutes.

#### **Convenient and easy to manage mill operation**

The gearless drive provides easy-to-manage operation modes for normal operation and positioning of the mill for liner change. These automatic procedures reduce the downtime of the mill drive considerably, and increase the availability of corresponding mills. New developments such as the Frozen Charge Shaker increase the availability of the grinding mill significantly. ■

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Haslestad (left) and Hagiwara combine forces on electrical drive systems for open-pit mining trucks

Siemens cooperates with Komatsu

# Colossus with New Drives

In the future, the Japanese machine manufacturer Komatsu will be equipping its heavy dumper trucks for open-pit mining with electrical AC drive systems from Siemens. The two companies have agreed on this cooperation. The new drive systems increase the performance of the trucks and also make them lighter.

The drive systems are used in open-pit mining trucks with a maximum load of 360 tons. The colossal trucks themselves have a total weight of almost 600 tons – equivalent to about 400 medium-sized automobiles. The dimensions are also gigantic: 15 meters long, 8 meters wide and 7.5 meters high. One wheel of these vehicles alone has a diameter of almost four meters and weighs almost 7 tons.

## More performance and higher load

The state-of-the-art technology of the Siemens drive systems is superior to comparable mechanical drives by offering much greater productivity, lower maintenance requirements and lower operating costs. “The use of electrical drive systems reduces the weight of the vehicles,” Ole Haslestad, chairman of the board and divisional head of Siemens I&S explains. “With the AC drive, we increase the performance and load of the trucks. Ultra-class loads will be possible in the future.” It took almost 16 months to develop the first drive system. Because the system had to pass numerous tests in a harsh environment. And this is how the drive works: AC voltage is generated by an AC generator connected to the main diesel engine, which is then rectified and stored briefly. Then the Siemens IGBT (insulated gate bipolar transistor) converters transform this voltage into a finely tuned voltage source which feeds the electric wheel motors on the truck’s rear axle. Through the optimized control of the voltage and frequency, the speed can be controlled in exactly the same way as in a completely normal private automobile using an accelerator pedal.

## Less weight, lower costs

In addition to the low operating cost, another advantage of the AC drive system from Siemens is that it supplies a high torque at standstill to accelerate the vehicle in heavy load applications. In addition, it also offers a high top speed of more than 40 mph and excellent braking properties. Thanks to the use of the electric wheel motors for braking the vehicle, the wear on the mechanical brake is also reduced, which also contributes to a reduction in the operating costs. “This puts us in a position to offer trucks with the lowest operating costs per ton on the market,” Toshiyata Hagiwara, chairman and representative director of the board at Komatsu, points out. ■

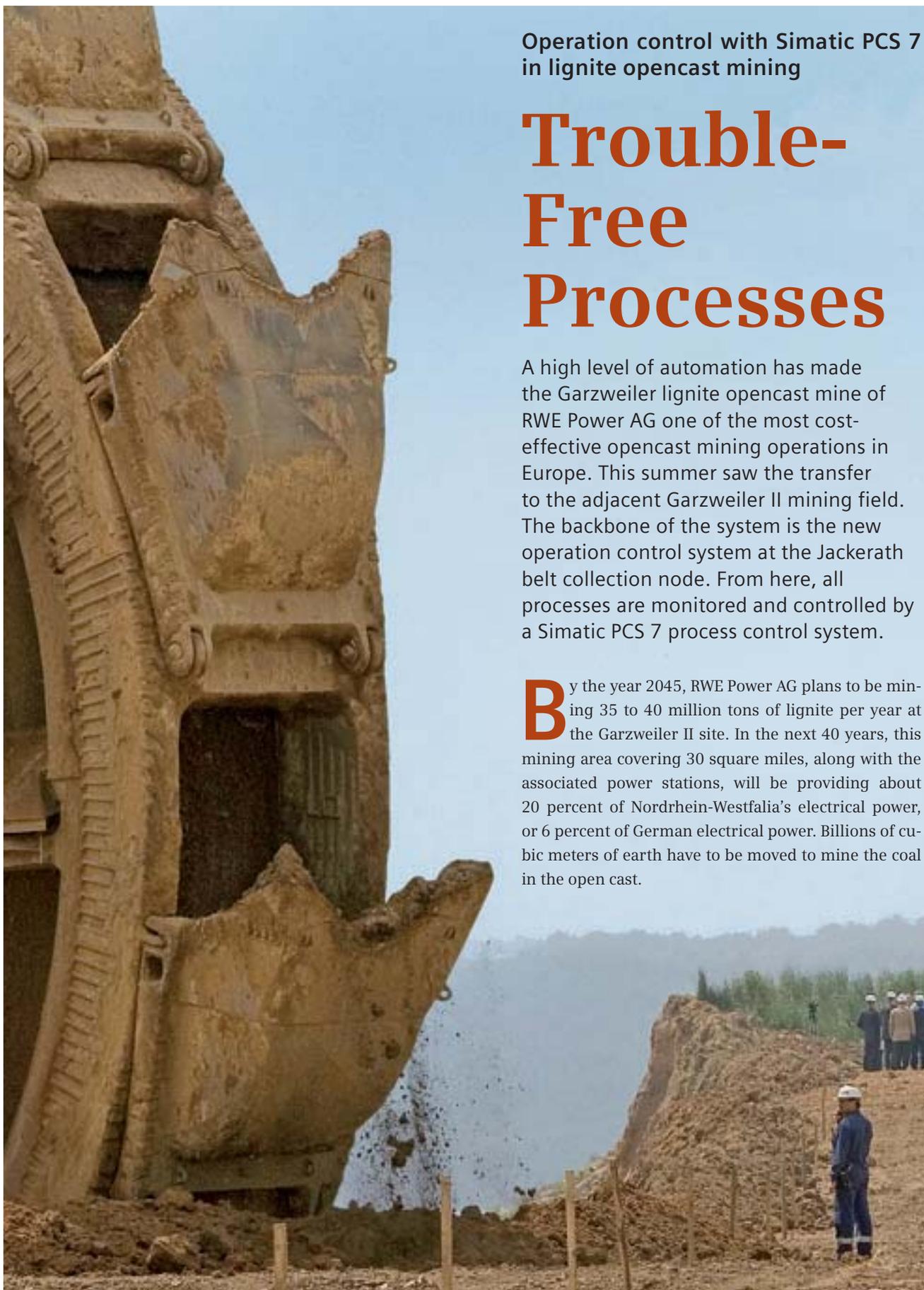
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Operation control with Simatic PCS 7  
in lignite opencast mining

# Trouble-Free Processes

A high level of automation has made the Garzweiler lignite opencast mine of RWE Power AG one of the most cost-effective opencast mining operations in Europe. This summer saw the transfer to the adjacent Garzweiler II mining field. The backbone of the system is the new operation control system at the Jackerath belt collection node. From here, all processes are monitored and controlled by a Simatic PCS 7 process control system.

**B**y the year 2045, RWE Power AG plans to be mining 35 to 40 million tons of lignite per year at the Garzweiler II site. In the next 40 years, this mining area covering 30 square miles, along with the associated power stations, will be providing about 20 percent of Nordrhein-Westfalia's electrical power, or 6 percent of German electrical power. Billions of cubic meters of earth have to be moved to mine the coal in the open cast.



### Extensive project, extreme demands

Earth and coal are transported by conveyor belts up to 2.8 meters wide and a total length of 50 miles to the belt collection node. At this juncture, the material is distributed to other conveyor systems. Much like a freight terminal, the employees monitoring the operation are able to control the material flows using modern automation technology. In this way, the coal is transported to the power station, coal bunkers or train loading stations while the earth is moved to the stackers.

Simple and safe engineering, maximum availability, service friendliness and the possibility of linking the systems to the master MES and ERP level were among RWE Power's requirements for the process control system. Modern control technology in lignite opencast mining means a distributed control technology in which information is acquired in the mobile units. The data is then transferred in a secure and trouble-free manner, the appropriate systems are linked, and consistent visualization is provided in the central process control system. After detailed preparation and specification of the requirements for the control equipment, RWE Power chose Siemens as the main supplier for the electrical systems at the beginning of 2004. This was followed by the design and configuration phase. In the spring of 2005, the main core of the actual process control system was installed.

### Tailor-made for Garzweiler II

The Siemens engineering team from Cologne implemented a modern solution based on the Simatic PCS 7 process control system. Faceplates were programmed for the visualization of the large devices as well as the conveyor route configurations and conveyed volume limits. To protect the control system against unauthorized access, the Siemens specialists used a detailed log-on concept.

The first conveyor systems with the process control system went into operation after approximately three

months. Since all of the belt systems and the process control system were designed via software in the Simatic PCS 7 project, tuning and engineering work for networking the signals of different systems was no longer necessary. With just one software project, it was possible to create and manage the signals and data configured for the conveyor systems directly, and later program the entire system.



RWE Power AG wants to mine 35 to 40 million tons of lignite per year at Garzweiler II

### Future-oriented technology

Simatic PCS 7 controls the belt systems in Garzweiler II in such a way that all of the transported products move in the right direction at all times. The status of drives, motors and gears is monitored for maintenance purposes. Five redundantly designed servers are in operation for all of the mobile and stationary conveyor route controllers, alarm processes and water processes. All processes are visualized on a total of 11 Simatic PCS 7 multi-clients with dual monitors: 26 Simatic S7-400 controllers control the 20 conveyor routes, and another 71 are used in the 67 belt station controllers and four bunker devices.

All mining devices and belt systems are interconnected and linked with the central control technology through fiber-optic cables via an open transport network (OTN). The OTN operates with almost all existing interface standards such as Industrial Ethernet, RS 485 or S0. This enables the transfer of different types of information over one network. The entire information for the process control, visualization and monitoring is prepared in the form of process data and evaluations. The core of this evaluation is a central process image with all data relevant to opencast mining. Time-critical process values are acquired and archived in a 100-millisecond cycle. The systems archive approximately 56,000 messages and 3,300 analog values from all of the belt stations, and about 12,000 messages and 600 analog values from the large devices. The archiving function, which stores the data of the last two years, enables the owner to make forecasts based on well-founded actual analyses.

### Consistently positive results

The last conveyor route went into operation in December 2006. The Simatic PCS 7 process control system ensures trouble-free operation of all processes at a high level. Thanks to progressive control technology, the conveyor system operates in an economic and reliable manner. RWE Power is very pleased. The process control system has lived up to all expectations concerning functionality and availability. ■

### Simatic PCS 7 in Garzweiler II

- 5 redundantly designed servers
- 11 operator stations
- 26 Simatic S7-400 controllers for controlling the 20 conveyor routes
- 71 Simatic S7-400 controllers in belt station controllers and bunker devices
- Archiving of approximately 56,000 messages, 3,300 analog values from the belt stations, about 12,000 messages and 600 analog values from the large devices

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CPMS installation  
at Rautaruukki  
Oyj, Raah Steel  
Works, Finland

## Coking Process Management System

# Better Coke

An optimized process control of coke-making operations is a decisive factor for a stable and disturbance-free coking process for producing coke of uniform and excellent quality. These objectives are to be met while taking particular care to minimize energy costs as well as assure a high level of productivity, a maximum battery service life and minimized environmental emissions. These targets can be attained by applying the Coking Process Management System, which is a state-of-the-art Level 2 control system designed for demanding battery conditions.

**T**he Coking Process Management System (CPMS) was developed by VAI Finland Ltd (VAIF), a business center of the Siemens VAI Metal Technologies Division specializing in cokemaking automation and technology. First generation CPMS solutions (statistical heating control) were commissioned in the early 1990s. Second generation CPMS solutions, featuring feedforward- and feedback-control applications for neutral pause time, dynamic scheduling and energy demand controls, was established in the mid-1990s. Third generation CPMS solutions included fuzzy logic and coking index control features that were incorporated into the system in the latter part of the 1990s. Since that time, new software tools and models have been introduced.

### System outline

Dynamic scheduling of coke-oven machine operations and optimized heating control of the coke-oven battery are the key issues for producing coke with excellent quality to fulfill the productivity demands of blast furnaces. Reliable positioning and interlocking of coke oven machines with the VAIPosi tool is an important part of the integrated control system. Smooth operations are another benefit, contributing to a long battery service life.

## Main Benefits

Reduced heating energy costs

Increased coke oven battery service life

Increased production rate

Uniform final coke temperature resulting in improved coke quality

Optimized process control of the coke oven battery

High degree of user-friendliness and ease of operation for process operators

CPMS conducts various process model calculations. The dynamic scheduling control of the coke oven machines and the heating energy control of the battery are the main features of the system. After each coke oven pushing operation, the dynamic scheduling model calculates and sends the relevant information for the next pushing time, together with the respective oven number in the pushing sequence, to

the coke oven machines for the operators to follow. By means of the heating control model, illustrated in the figure, the heat energy input into the battery is optimized. The control aims for a uniform end temperature of the coke within the entire battery. Heat adjustments are based on a set-point calculation of the neutral pause time (i.e., heating break time) after each gas reversing in the battery. Since the third generation version, CPMS utilizes state-of-the-art fuzzy logic control principles for automatic heating control.

## Industrial applications

VAIF has considerable experience in the design, planning, development and implementation of automation and process technologies for the iron & steel and coke-making industries, and can point to references in over 30 countries worldwide. CPMS solutions have been employed at the coke oven batteries of Ruukki (Rautaruukki Oyj, Raahel Steel Works) in Finland for more than fifteen years, with very good results. Thanks to the excellent coke quality, the blast furnaces of Ruukki have been ranked for years among the most productive blast furnaces worldwide.

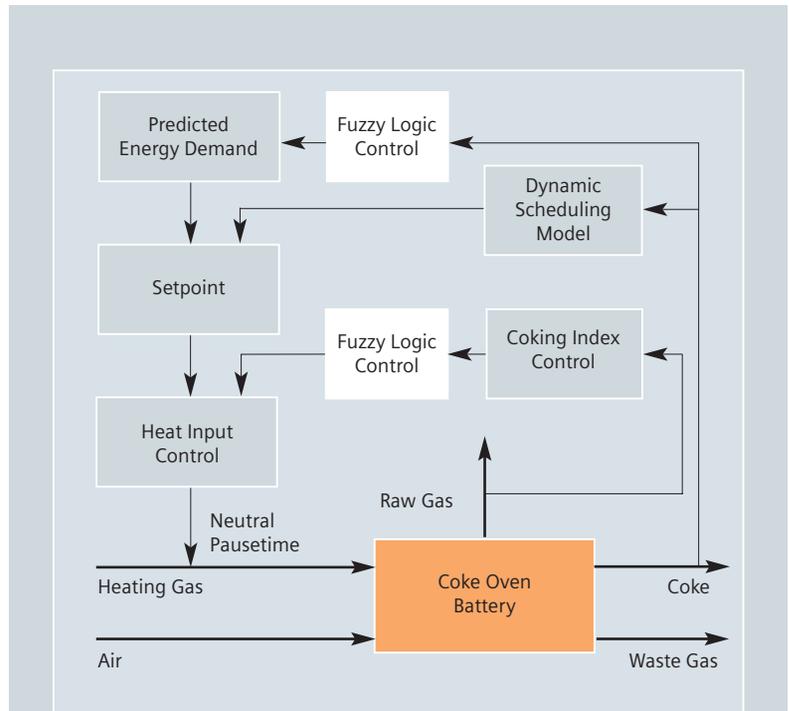
VAIF has successfully commissioned 21 coke oven automation projects, including nine complete CPMS systems. Seven technology projects were also implemented for various sizes and designs of coke batteries, for coke dry quenching and for coke oven gas treatment plants since 1995. Three new CPMS/battery automation installations are currently underway in China and India. ■

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Principle of the dynamic heating control model for optimized cokemaking

## Trends in cokemaking operations

Since the development of the unmanned coke quenching car in the early 1990s – jointly together with the coke dry quenching process (CDQ) – much attention and effort has been paid on improving and increasing the reliability and level of the automation systems for other coke machines in the direction of unmanned operations.

Increasing coke quality demands and limited coal reserves with coking quality will pose even greater challenges for the development of automation and modeling solutions for cokemaking processes. Furthermore, cost-cutting measures and reduced personnel for process operations will place additional pressure on the need to develop and implement new management tools. This will lead to increased utilization of computer systems for certain maintenance functions and for an efficient control of equipment.

Technical innovations for improving environmental protection and fulfilling the legal requirements will play a more significant role in future development work. CPMS and other VAIF products for coke ovens are being developed to meet these demanding challenges.

Construction of the world's largest Corex plant continues at Baosteel, China

# Next Generation Corex Technology

On a greenfield site near the city of Shanghai, construction activities continue at a frantic pace to complete the first Corex<sup>®</sup> plant in China, and what will be the world's largest Corex plant to date. The 126-meter-tall Corex tower dominates the landscape and demonstrates China's commitment to technological innovation and environmental compatibility in iron- and steelmaking.

Corex technology is an acknowledged process for producing liquid hot metal in a quality which is identical to hot metal produced in blast furnaces. The Corex process was developed in the late 1970s, and its feasibility was confirmed during the 1980s. Following the first industrial application of a Corex C-1000 plant at Iscor/ South Africa, four C-2000 plants were subsequently put into operation at Posco/ Korea, Mittal Steel/ South Africa and at Jindal/ India. To date, a combined total of more than 25 million tons of liquid hot metal have been produced by these plants. The technical developments, further process improvements and operational experience allowed

Siemens VAI to introduce the next generation of Corex plants to the iron and steel industry, also known as the Corex C-3000 module.

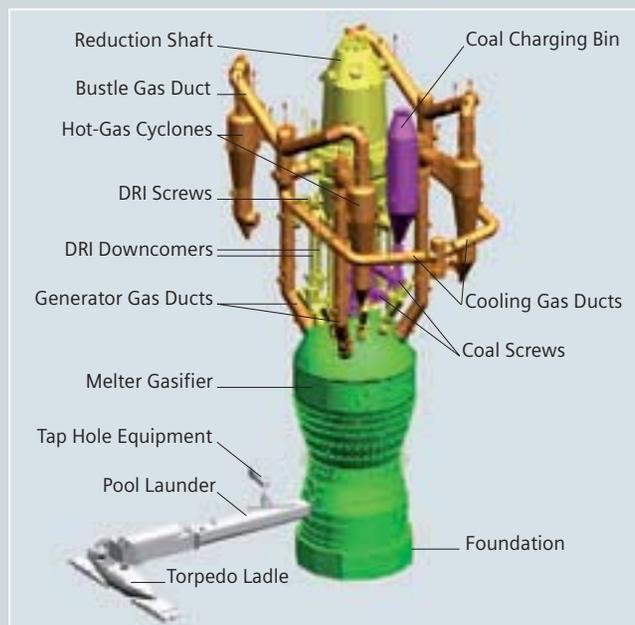
Baosteel, one of the largest steel manufacturers in China, closely observed the development of the Corex process and the advantages offered through the direct use of coal as the principal source of energy. With the need to relocate their Pudong steel works to the Baosteel industrial area in Shanghai in order to create space for the World Expo 2010, the decision was made to implement the Corex process for the first time in China. The contract was signed between Baosteel and Siemens VAI on June 9, 2005.



Figure 1: 3D Design of Corex plant



Figure 2: Schematic view of main Corex plant sections





Construction status as of November 9, 2006

The Corex plant is part of an entire steel works complex which also includes LD (BOF) converters, ladle furnaces, a slab caster and a plate mill. The gas from the Corex plant will be utilized in a combined cycle electrical power station as well as for heating purposes throughout the plant. In the first stage, the slab production will be 1.5 million t/a.

Since signing the contract, more than one and a half years have passed. After completion of the engineering of the Corex facility, the civil works and the mechanical and structural erection could start in time. The design of the Corex tower was executed applying 3D model tools (Figure 1). The key process equipment of the Corex process, including melter gasifier, reduction furnace, the hot-gas cyclones and the connecting duct work, is schematically illustrated in Figure 2. The status of the construction activities at the Corex tower area as of November 9, 2006 can be seen in the photograph.

### Reasons for Baosteel's decision for Corex

Economical and environmentally friendly production of hot metal

Possibility to use a wide range of coals in the process (as opposed to the need for coke with blast furnaces)

Extensive operational experience with the Corex process

### Project scope of supply

The scope of supply and services for the entire Corex facility, including raw material handling and coal drying, is split between Baosteel and Siemens VAI. Baosteel is principally in charge of the ancillary facilities such as raw material handling and the water-treatment plant, etc. Siemens VAI is responsible for the entire engineering of the core process units, and will supply key process equipment such as coal drying equipment, the hot-gas generator, screw conveyors (for extracting DRI from the reduction shaft and for the transport of coal to the Corex melter gasifier), two Gimbal Top charging systems (one for the charging of burden into the reduction shaft and one for the charging of coal into the melter gasifier)

as well as gas-cleaning equipment, cooling-gas compressors, gate valves, electrical equipment for Level 1 and Level 2 automation as well core instrumentation.

### Outlook

With respect to the ongoing project activities, start-up and commissioning of the Baosteel Corex C-3000 plant is expected in the fourth quarter of 2007. Provisions have also been made to allow for the conversion of the Corex plant into a Finex plant, which then would allow for the direct charging of fine iron ore into the process for the production of high-quality hot metal. ■

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The Dynacon process optimization system for oxygen steelmaking

# Nothing Left to Chance

The primary objective in converter automation is to optimize the steelmaking process using advanced process models. In this article, the Dynacon process optimization system is presented which dynamically determines the blowing end point on the basis of continuous offgas measurements with the integrated LOMAS® system. With this solution, the time-consuming and cost-intensive sample-taking procedure can be significantly reduced, along with a major boost in steelmaking productivity.



Example of Dynacon monitor screen for LD (BOF) steelmaking converters



Installation of LOMAS gas analysis system in the converter hood

Process optimization systems (Level 2) are applied to supervise and control steelmaking operations, from the ordering of hot metal and scrap to the alloying during tapping. Process tracking modules and the generation of setpoints are based on predefined production practices, and on the results from different process models that are activated according to the ongoing treatment phase. The required material quantities and compositions, the time when they are to be charged into the converter, as well as the exact volume of oxygen to be blown are calculated to produce a heat in accordance with the production plan, and which satisfies the specific steel-grade requirements.

#### Process optimization models

Siemens VAI offers a series of innovative metallurgical process models to meet the requirements for efficient and cost-effective steelmaking. For example, with the SteelExpert FCC and the SteelExpert SCC Models (first and second charge calculation), all materials to be charged into the converter are determined and a complete precalculation of the blowing process is performed. With the SteelExpert Reblow Model, the re-

quired oxygen volume and vessel additions are calculated in the rare event that reblowing is necessary. The SteelExpert Alloy Model calculates the necessary amount of alloying materials to be added during tapping. Material prices are taken into consideration for a cost-efficient material combination. These and other LD process optimization models have been installed in numerous converters worldwide, and the resulting advantages are well documented.

#### Dynacon process optimization model

A key concern in LD (BOF) steelmaking is the exact determination of the blowing endpoint. Rapid changes in the temperature and chemical composition of the steel bath during oxygen blowing complicate predictions, and direct continuous measurements are currently not possible. In conventional steelmaking practices, the steel temperature and composition is measured at the end of the heat production cycle on the basis of steel >>

#### Main Benefits

- Online calculation of steel and slag properties
- Automatic blow-end control and avoidance of overblowing
- Improved hitting ratio of targeted carbon and temperature values
- Fewer reblows required
- Reduced Fe content in slag
- Reduced Al consumption for deoxidation



- >> samples. This involves an interruption in the steel-production process, and a corrective oxygen reblow is usually required. This means a loss in production and a possible disruption in production scheduling.

With the state-of-the-art Siemens VAI SteelExpert process model, referred to as Dynacon, a dynamic calculation of the temperature, weight and chemical analysis of the steel, slag and offgas is cyclically performed throughout the entire steelmaking process. This approach takes into account thermodynamic and kinetic reactions, and the calculated values have a high degree of accuracy.

In combination with LOMAS (the low maintenance analyzing system), which analyzes the converter off-gas, the supervision and control of the production process can be improved even further. LOMAS, with 91 units sold worldwide to date, is a well-proven solution for the continuous measurement of the CO, CO<sub>2</sub>, O<sub>2</sub> and N<sub>2</sub> content of the offgas. Installed in the converter hood above the steelmaking vessel, the unit is designed to withstand high temperatures, extreme dust loads and a corrosive reducing environment. With the use of an integrated mass spectrometer, the analy-

sis results are transmitted in two-second intervals to the Dynacon system.

During the blowing process, Dynacon cyclically calculates the actual carbon content in the steel bath and the decarburization rate. A significant change in the off-gas composition near the end of the refining process allows the exact end-of-blow time to be determined. Oxygen injection is automatically stopped when the targeted carbon content of the steel bath is reached. With this solution, valuable minutes in the steelmaking process are saved, leading to a higher production output and improved revenues. ■

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## Retractable Dynaflex oscillator for billet casters

# No Stops During Mold Change

With a conventional billet caster design, a mold change means nothing short of a complete production stop. In order to change the mold of even a single strand, the casting operations on all other strands in a multi-strand caster must be interrupted. The tundish has to be removed from its normal operating position before a service crane can lift the mold from the machine head and replace it. This invariably brings with it plant downtime and production loss.

**T**hrough the installation of a retractable Siemens VAI Dynaflex oscillator and mold unit, however, it is possible to uphold casting operations during a mold change. At the push of a button, all mechanical connections are hydraulically released and an entire billet machine head – including the mold, mold table as well as the oscillator itself – are removed from the casting position. This is made possible through the design of the Dynaflex mold unit as a retractable system, which is mounted on a moveable carriage outfitted with supporting wheels. Whenever a mold requires replacing (either for maintenance reasons or for format changes), the unit is rolled out away from the casting position to an area where it can be lifted and removed by the service crane. A replacement mold is then inserted into the unit, after which it is rolled back into the casting position. From stop to restart of casting operations, the entire procedure takes only 15 to a maximum of 20 minutes. This includes mold replacement, insertion of the dummy bar, as well as all mold packing operations.

### Combined advantages

The described solution combines the field-proven advantages of the Dynaflex oscillator (including wear-free mold oscillation, online adjustment of the mold oscillation parameters according to the steel grades and casting speed, improved strand surface quality and



Retractable oscillators installed at the 6-strand billet caster of Ferriere Nord in Rivoli di Osoppo, Italy

fewer breakouts) with the capability for non-stop casting operations on other strands. As such, it is a particularly attractive solution for customers operating at or near capacity limits, and who cannot afford production stops. The retractable Dynaflex oscillator/mold system allows for continuous casting operations, and thus a significant increase in caster output.

### Industrial application

A retractable Dynaflex oscillator/mold system was installed on the existing 6-strand billet caster of Ferriere Nord (Pittini Group) in Rivoli di Osoppo, Italy. Implementation of the technology required only four weeks. An uninterrupted casting sequence of 23 heats was already achieved on the first day following re-start. Production output was subsequently even increased to a record 49 cast heats in sequence. With the help of the retractable Dynaflex oscillator/mold solution, Ferriere Nord was able to reduce the breakout rate by 37 % while increasing overall productivity by 25 %. Simultaneously, the billet rejection rate at the rolling mill was reduced by 50 %.

### Greater output and profits

Based on actual experience gathered during operation, it was shown that the installation of a retractable Dynaflex oscillator is a highly economical solution, resulting in greater casting output and additional profits. The return-on-investment (ROI) with this solution is estimated to be in the range of only one to two years maximum.

### Main Benefits

- Non-stop billet production during mold replacement
- Fully automatic retraction operations
- Fast mold exchange within 15–20 minutes
- Increased productivity
- Short return-on-investment (ROI)

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Car-counted AOD converter (ZPSS)

The respective plant configurations underscore the wide range of flexible solutions offered for efficient and cost-effective stainless steel production on the basis of available charge materials and market requirements.

#### Taiyuan Iron and Steel Co. (TISCO), Taiyuan, Shanxi Province

With a production capacity of two million tons per year, TISCO boasts the world's largest stainless steel melt-shop. This facility, which was started up in September 2006, is characterized by two separate, highly flexible and integrated production lines consisting of two 160-t electric arc furnaces (EAF), two 180-t AOD (argon oxygen decarburization) converters, a twin-station ladle furnace and two single-strand slab casters, in addition to all auxiliary equipment (Figure 1).

Hot metal is partially used as an input material for the production of stainless steel, reducing the dependency on the tight stainless steel scrap market in China. Following dephosphorization and partial decarburization in an LD converter, the hot metal is charged into an EAF together with stainless steel scrap and/or ferroalloys for melting. Foamy slag practice is applied to reduce consumption figures and chrome oxidation. The premelt is then end-decarburized and refined in the AOD converter guided by a sophisticated process model to assure that target values are reached. Final composition and temperature adjustments are carried out in the ladle furnace prior to continuous casting.

#### New chinese stainless steelmaking plants from Siemens VAI

# China Goes Stainless

Stainless steel production is on the rise in China. In 2006, the world output of crude stainless steel exceeded 25 million tons, of which China accounted for nearly five million tons. Siemens VAI, by far the largest supplier of stainless steelmaking plants in China, recently commissioned three state-of-the-art facilities at TISCO, ZSSP and LISCO with a combined nominal output of 3.8 million tons per year.

The new steel plant features a state-of-the-art dedusting facility, which reduces emission values to levels well below international standards.

For the same company, three smaller 45-t AOD converters were supplied by Siemens VAI in 2003, in addition to a 60-t K-OBM-S converter, which allows both carbon and stainless steel to be produced. TISCO is also a major producer of carbon steel – one month before the start-up of the two stainless steel production lines, two 180-t LD (BOF) converters were commissioned by Siemens VAI.

#### Zhangjiagang Pohang Stainless Steel (ZPSS), Zhangjiagang, Jiangsu Province

A new 800,000 t/a stainless steelmaking plant was started up by Siemens VAI in September 2006 at ZPSS (near Shanghai), which is a joint venture between POSCO (Korea) and the Shagang Group (China). This facility consists of a 140-t EAF, a 150-t AOD, a twin-station ladle stirring stand and a single-strand slab caster (Figure 2).

The EAF is equipped with refining combined burners (RCB) for multi-purpose applications as either a burner lance, an oxygen injection lance or a carbon-injection lance for post-combustion purposes. A special feature of the AOD converter is that the complete trunnion and suspension system of the converter is mounted on a movable car, including the bearings, drive and a local pulpit. The advantage of this solution is that when relining and repair is required, the converter can be quickly and eas-

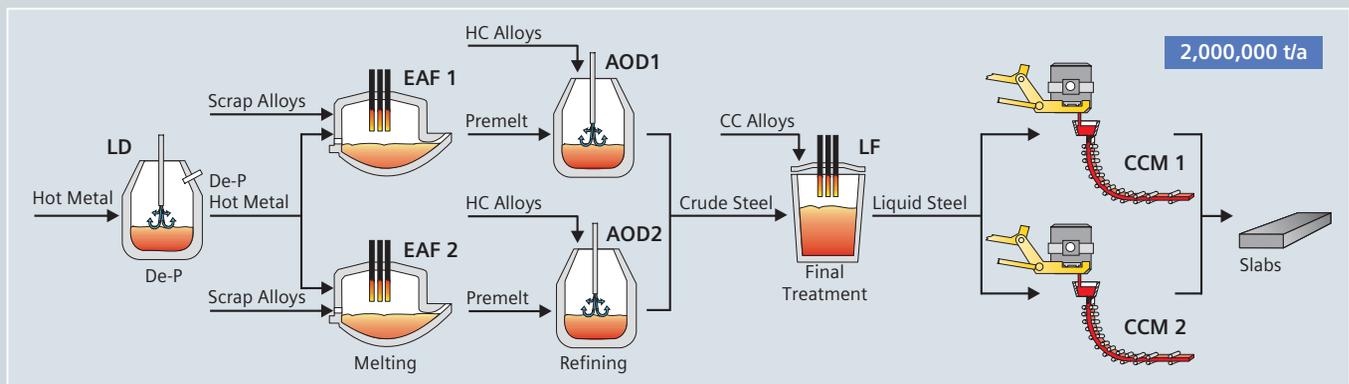


Figure 1: Plant configuration at TISCO

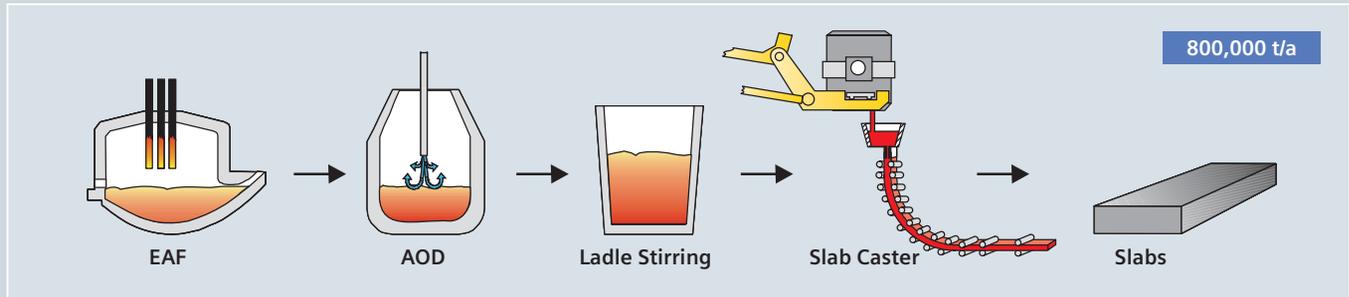


Figure 2: Plant configuration at ZPSS

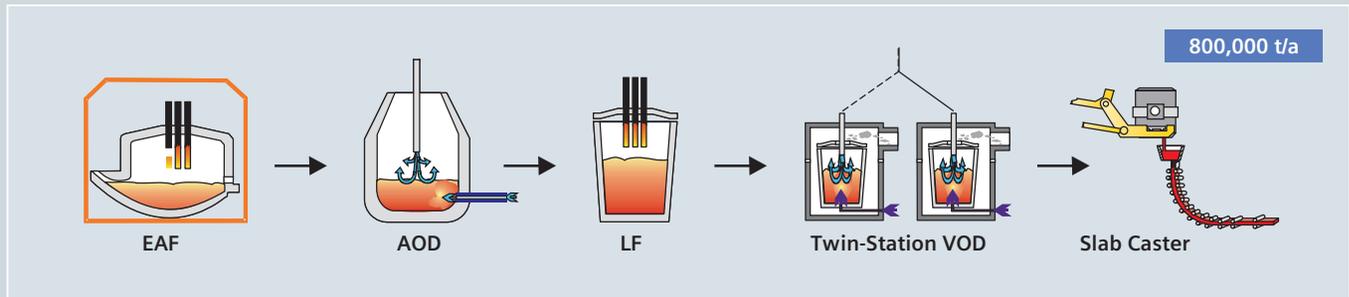


Figure 3: Plant configuration at LISCO

ily moved from its operating position to a site where it can be lifted from the trunnion ring and transported by a crane to the relining station and quickly replaced. Production interruptions for maintenance work can be kept to a minimum with this solution.

Fully automatic AOD process control is made possible with the use of the Lomas® offgas analyzer (see Dynacon article, pages 26–28) and substance equipment.

### Lianzhong Iron and Steel Co. (LISCO), Guangzhou, Guangdong Province

The new stainless steelmaking plant of LISCO has a nominal output of 800,000–1,000,000 t/a, which is produced in a single production chain comprising a 140-t EAF, a 170-t AOD, a single ladle furnace, a twin-station VOD (vacuum oxygen decarburization) and a single-strand slab caster (Figure 3). In combination with advanced Level 1 and Level 2 automation systems, comprehensive process models for the melting and refining units, the secondary metallurgical facilities and the slab caster are the basis for fully optimized operations at every step of production. A specialty of the LISCO

meltshop is its extraordinary flexibility to produce a wide range of stainless steel grades and qualities. Highest quality steel with extremely low contents of carbon, nitrogen and hydrogen can be produced thanks to the installation of the VOD unit.

About 80 percent of Lianzhong’s stainless steel will be sold to the domestic market, while 20 percent is destined for export to overseas markets.

### World’s largest steel producer

In the course of only a few years, China has transformed itself from the world’s biggest importer of stainless steel to the world’s largest producer. The recently completed stainless steelmaking plants at TISCO, ZPSS and LISCO, with a combined annual capacity equivalent to 15% of the total world output, underscores China’s success not only as a mass producer of steel, but also as a producer of highest quality steel for demanding applications. ■

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Single strand slab caster

## Continued success in Siemens VAI continuous casting technology

# A Better Mousetrap

In the 50-year history of Siemens VAI's continuous casting technology, the past five years have been the most successful yet with respect to the number of received slab, bloom and beam blank caster orders and plant start-ups. The winning formula: a better mousetrap, that is, a better product.

In just the past two years alone, between January 2005 and December 2006, a total of 54 casters were started up in 19 countries, and 50 orders were received from steel producers in 17 countries for the supply of new or the modernization of existing casters of this type.

From 2001 to the end of 2006, Siemens VAI was awarded more than 50 % of all slab-casting projects and a large percentage of the bloom and beam blank caster projects on a worldwide basis. VAI's global market share for caster revamping projects was more than 60 % during this same time period. During the previous two years, Siemens VAI slab, bloom or beam blank casters were started up in Austria, Belgium, Bulgaria, Canada, China, India, Kazakhstan, New Zealand, Russia, Serbia, South Korea, Sweden, Taiwan, Ukraine, the United Kingdom and in the USA. As a comparison, the entire combined nominal casting capacity of all of these machines adds up to an impressive 72,000,000 tons of steel – equivalent to 75 % of the steel output of

the United States in 2005. On average, a Siemens VAI caster was started up every 14 days during the past two years.

### Improved caster performance and operations

Examples of innovative solutions for improved caster performance and operations include SmartMold (a specially designed cassette-type mold which allows the quick exchange of Cu plates); the MoldExpert system (a milestone for online automatic breakout prediction and strand shell friction monitoring); and LevCon (an automatic mold level control system which includes "autostart" casting functions).

### Improved quality

Examples of solutions which enhance product quality include the patented DynaFlex (a hydraulic oscillator which contributes to an improved strand surface quality and employs a wear-free mold guidance system – 88 orders to date); Dynacs® (a dynamic second-



**Andreas Flick (l.), business segment head, continuous casting and Andreas Jungbauer (r.), product manager, continuous casting Siemens VAI, Linz/Austria**

“The impressive track record of Siemens VAI’s continuous casting technology is the result of our company’s permanent emphasis on the latest equipment design, technological packages and automation solutions that keep our customers competitive.”

**Andreas Flick**



**LiquiRob® testing in the Siemens VAI industrial laboratory**

ary cooling system that provides optimum cooling conditions during all casting conditions – 91 orders to date); the Star Roller Family (for ideal strand support and cooled with different cooling systems depending on which steel grades are cast – more than 15,000 rollers supplied to date); the patented Dyna-Gap Soft Reduction® solution (a fully automatic roll-gap control system which allows dynamic soft reduction to minimize centerline segregation and which further improves internal strand quality, especially during transient casting conditions – 62 orders to date); and the VAI-Q Quality Control System (online quality tracking and control contributing to the continuous improvement of operational and metallurgical know-how).

#### **Improved flexibility**

Increased operational flexibility is provided by Dyna-Width (an online mold-width adjustment system which allows flexible and fast slab width changes, also at high casting speeds – 63 orders to date); the SMART®Bender (a fully remotely adjustable first casting section which enables quick thickness adjustments to be carried out, especially suitable in casters where frequent slab thickness changes are required); and the SMART®Segment (a specially designed strand guide segment which allows online and remote roll-gap adjustments to be carried out for slab thickness changes as well as to enable dynamic soft reduction – more than 1,000 units sold to date). The SMARTSegment won the Siemens top+ Team award in 2006 for the category “Innovation.”

#### **Fast plant start-ups**

Fully integrated project management processes and procedures, from the start of a project to its completion, is the key for optimum plant design, equipment and system integration as well as reliable process operations. Connect & Cast® solutions are the basis for achieving the fastest plant start-ups. Extensive testing of components and systems in the workshop prior to delivery is also a decisive factor for immediate and fully automatic operations to be carried out right from the first cast.

#### **Outlook**

In addition to the further development and application of technological solutions, aspects of personnel safety will continue to be emphasized in Siemens VAI’s continuous casting technology. Particularly on the casting platform, where the hazards of liquid steel are well known, “robot” solutions designed for operation under harsh steelmaking conditions are now available to carry out all casting operations on the casting platform. With LiquiRob®, patented engineering solutions are combined with the reliability of industrial robots, allowing casting personnel to monitor the entire casting process from a safe distance. The first LiquiRobots are scheduled to be put into operation in 2007. ■

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A new spooling process for long products

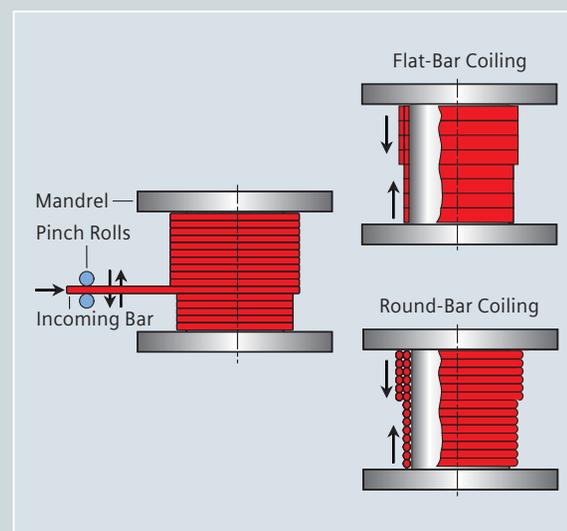
# Better Bar Coiling

A recently developed spooling process from Siemens VAI is a major technology step forward for bar-in-coil production. Round, flat, square or hexagon bars are wound in a twist-free manner into a compact coil on a vertical mandrel with a high coiling density. With the described solution, higher coiling speeds, lower processing-costs and a host of other advantages are achieved.

IRON & STEEL >



< Even with a weight of 2.9 tons, the compactly spooled coil (l.) is considerably smaller in size compared with the 1.5-ton wire rod-type coil (r.)



Principle of bar spooler

In a conventional Garret coiling system, rolled bar is fed into a vertical drum, which rotates according to the speed of the incoming bar. The bar is deposited in a series of successive rings into the drum in a random, disorderly and tension-free manner. In this type of coiling process, the bar becomes twisted and the coil bundle has a relatively low coiling density which means that for a required coil weight, a relatively large coil volume is the result. Special machinery is required prior to wire-drawing operations to uncoil, untwist and recoil the bar, incurring unnecessary costs.

## A better solution

Siemens VAI now offers a spooling system which overcomes these disadvantages. Rolled bar is vertically wound under tension onto a rotating mandrel. The rotation speed of the mandrel is synchronized with the

speed of the incoming bar, and according to the increasing diameter of the coil during winding. A moveable ring distributor spools the bar onto the mandrel in orderly, highly compact adjacent rings. Because the bar is always under tension during the spooling process, the coil rings are in perfect alignment, even at high coiling speeds and with small bar diameters.

Speeds of up to 35 m/s for 8- and 10-mm bars are easily reached with this spooling system, as opposed to an approximate maximum speed of 18 m/s in Garret coiling. In wire-rod and Garret-line coiling, approximately 90% of the produced coils have a weight of 1.3–2.3 tons. With the new spooling process, a whole range of customized coil weights between 1,500 and 5,000 kg are possible. A higher coil density and weight facilitates logistics and substantially reduces storage-space requirements. With higher possible coil weights,

the overall material yield in the downstream cold-processing section can be increased as well.

Twist-free operation eliminates the need for off-line decoiling, stretching and recoiling operations, saving time and money. As the axis of the spooling mandrel is aligned in the vertical direction, a coil tilter is not necessary.

Another advantage: in Garret-type non-tension coiling it is very difficult (and sometimes impossible) to produce quenched and tempered rebars. Coiling is possible with up to 16-mm-diameter bars, but the coil produced does not meet shape and quality requirements. For greater diameters (18–32 mm), coiling op-

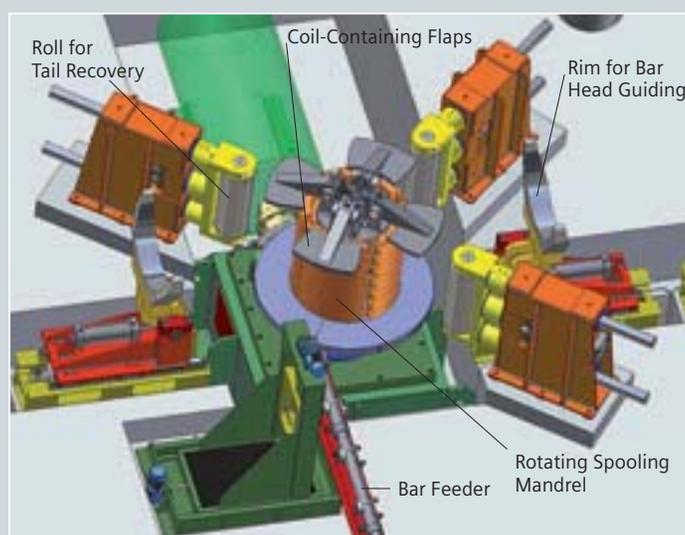
- A ring distributor which feeds the bar onto the mandrel in a perfectly aligned manner
- A spooling unit with a controlled rotational speed of the mandrel, providing the necessary tension on the bar for precise coiling

The following equipment units are common to both lines:

- A jib crane which removes the finished bar coil from the spooling unit
- Two strapping machines
- A fork elevator and walking beam to transfer the bar coil to the handling area



View of the spooling and strapping sections



Spooler area

Bar from Rolling Mill

erations are impossible. The reason for this is because the rigidity of the quenched bars is very high, which limits the coiling capability in Garret coiling.

This is not a problem with winding under tension, and it is possible to coil quenched and tempered bars with diameters of up to 32 mm at very low temperatures (down to approximately 580–600 °C for low-carbon steel). Thus, the Siemens VAI spooling process enables the mechanical properties of steel to be adjusted and homogenized at a much greater range than with Garret-type coiling.

### Equipment

The Siemens VAI spooling system includes alternatively operating spooling lines, each comprised of:

- Two-pinch rolls with a looper to exert a suitable tension to the bar during coiling

### Warranting a closer look

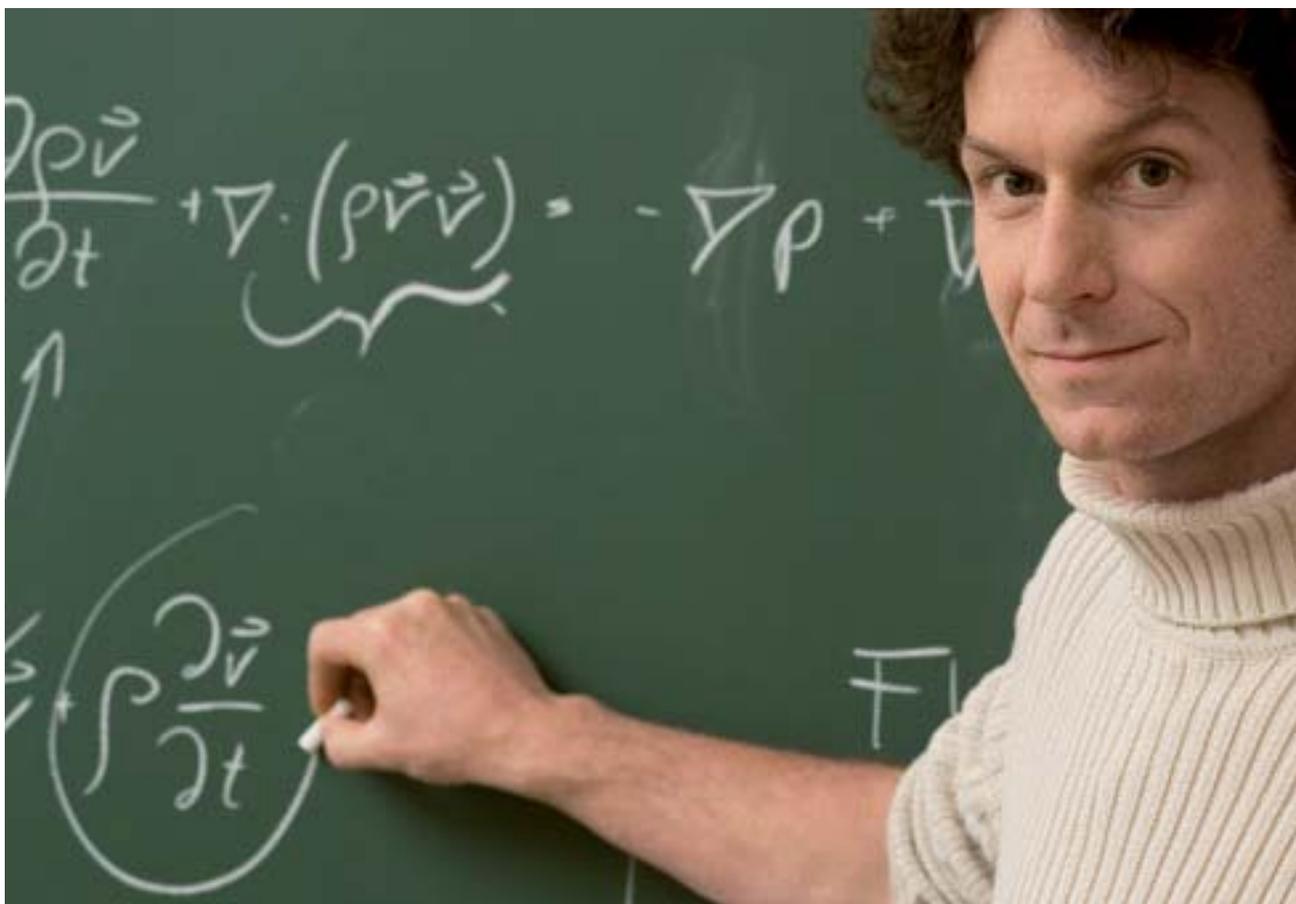
The numerous technological, production process, product quality and cost advantages offered by the new bar-spooling system from Siemens VAI warrant a closer look by wire rod producers. Improved competitiveness and the opportunity to enter niche markets with a greater range of steel grades open up new market opportunities for steel producers. ■

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Investigation methods in steelmaking and environmental technologies

## In Search of the Answers

At the recent Iron and Steelmaking Conference in Linz, Austria, held in October 2006, Stefan Pirker of the Johannes Kepler University delivered a lecture on the topic of investigation methods in steelmaking and environmental technologies. In the following article, he evaluates these methods, also stating which of them he considers to be the best.

**T**he Johannes Kepler University in Linz, Austria comprises 11 mechatronics institutes that are well known for their close relationship to industrial research. In our Institute of Fluid Mechanics and Heat Transfer, seven out of ten scientific employees are funded by the industry. As an academic researcher, I have always been enthralled by this proximity to application.

### Industrial flows and the three columns of fluid mechanics

In many cases, the basic flow condition is crucial for the performance of industrial processes. Therefore, a detailed investigation of the flow situation is essential

for a better understanding of corresponding industrial plants. In recent years, numerical simulations have proven to be an efficient investigation tool for applied flow situations. Nevertheless, numerical simulations should not be regarded as a stand alone measure, but rather as a further investigation tool alongside analytical considerations and similarity experiments. These three methodologies – measurements, analytical approaches and numerical simulations – are often regarded as the three columns of fluid mechanics.

### Measurements

In an industrial environment, measurements tend to be difficult, expensive and time consuming. In some cases,

for example in liquid metal baths, direct measurements are even impossible. Therefore, it is common practice to perform small-scale experiments instead, and to extrapolate the results by applying similarity rules. Fortunately, the viscosities of liquid steel and water are in a similar range, so that a simple flow situation of liquid steel in a reactor can be modeled through a geometrically similar small-scale cold water model. Nevertheless, in the case of multiphase flows, a comprehensive physical similarity generally cannot be achieved through small-scale experiments. Even so, experiments could help to check and validate other investigation methods such as numerical simulations.

### Analytical approaches

Looking at complex multiphase industrial flow situations, it is hard to imagine that simple analytic considerations could help to develop a deeper understanding. Nevertheless, in many cases, complex processes might be split into physically relevant subdivisions that can be visualized through basic analytic models. Once they are set up, analytic models are very useful to highlight basic trends or the sensibility with regard to certain process parameters. After all, analytical considerations are essential for developing a link between small-scale experiment results and real plant operations.

### Numerical simulations

Commercial computational fluid dynamic (CFD) packages enable a comprehensive and detailed look into industrial flow situations. Thanks to very stable numerical algorithms, a solution to a given problem can be obtained within days or weeks, and colorful, even animated, pictures are the result. One major problem with

numerical simulations is that the correctness of the received solution cannot be guaranteed. Sources of failure could include modeling errors, for example, the use of an improper turbulence model, as well as numerical discretization and truncation errors. Furthermore, more prosaic errors might stem from uncertainties in the definition of boundary conditions, and also ordinary software bugs.

As numerical simulations are very prone to errors, an expert in the field of fluid dynamics is needed for operating commercial CFD packages. Even so, numerical results should at least always be checked by analytical estimations, or compared to known observations. Another possibility in gaining confidence in the solution involves comparing numerical results with measurements. It is wise to at first simulate small-scale experiments in order to validate the simulation methods, before starting the very real plant simulations.

### Conclusion

All in all, the question of which investigation technique is best for a given process is not easily answered. In an optimal scenario, all three approaches should be applied, and the results counterchecked. Nevertheless, especially if a research cooperation is driven by an actual industrial project, short-term CFD simulations are often chosen as a stand-alone investigation tool. But are these preliminary results trustworthy?

After ten years in the field of applied flow research, I would suggest two alternative procedures. First of all, market-driven projects should be backed by long-term research partnerships in order to enable the consideration of all three investigation methods. In Austria, Christian Doppler laboratories and thematic competence centers provide a suitable platform for this. Secondly, for time-critical projects, the three investigation methods could be handled by different specialized groups, and the results evaluated in a networking manner in order to gain reliable conclusions. ■



### Curriculum Vitae

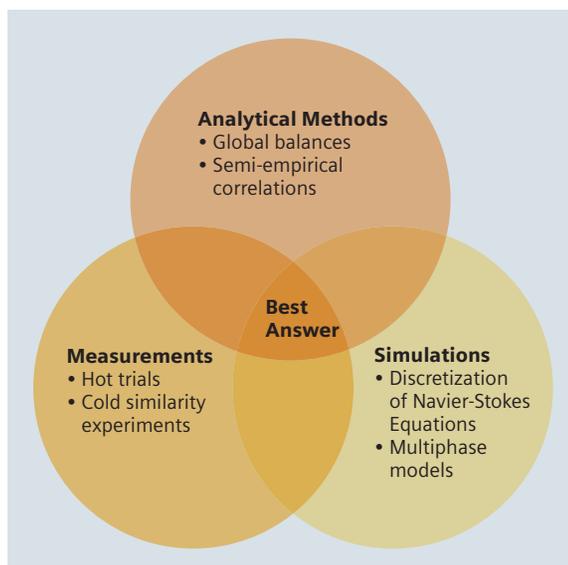
#### Stefan Pirker, PhD

1996–2001: Assistant at the department of Fluid Dynamics and Heat Transfer of the Johannes Kepler University, Linz, Austria

2001: PhD in mechatronics with focus on numerical simulation of metallurgical flows

Currently: Senior Researcher with focus on particulate flows at the Johannes Kepler University, Linz, Austria

### The best answer forms the intersect of analytical methods, measurements and simulations



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MULPIC machine  
at POSCO #3 plate  
mill, Republic of  
South Korea

MULPIC technology improves steel plate quality for linepipe applications

## Precision Cooling

Microalloyed steel plate ranks among the most versatile modern engineering materials. Today, it is possible to produce steel plate with various microstructures and physical properties through careful selection and control of the strain-temperature path during the rolling process. In cooperation with CRM of Belgium, Siemens VAI developed the MULPIC<sup>®</sup> accelerated cooling system and its direct-quench extension, an inline technology that enables maximum efficiency and precision in the control of plate production.

**D**emand for microalloyed steel plate is particularly strong in the oil and gas pipeline construction industry. Modern gas pipelines operate under very high pressures, somewhere in the order of 200 bar, and must also be able to withstand widely varying climatic environments. The current nature of the fossil fuel market means that newly exploited reserves are always marginal. This poses ever new challenges for pipeline construction, fabrication and service integrity. Steelmakers must continuously improve the crack and corrosion resistance of steel plate to create a wider and stronger product.

### Accelerated cooling technology

Today, accelerated cooling technology is universally recognized as a key process technology in linepipe manufacturing. In the modern plate mill, the microstructure of the steel at the completion of rolling is already precisely controlled. However, it can be refined even further by following a closely controlled cooling path. By integrating the cooling system into the inline processes of the mill, it is possible to achieve combinations of physical properties which are otherwise intractable. This includes the use of lean-alloyed low carbon steel compositions that offer excellent weldability,

Customer	Width (mm)	Mill Gauge Range (mm)	Cooling Section Length (m)	Type of Order	Start-Up Year
POSCO #3 (South Korea)	4,200	10-120	24	Stand-Alone System	2004
Zhangjigang (China)	5,000	10-120	24	Part of Full Mill Supply	2006
POSCO #2 (South Korea)	5,000	15-120	30	Stand-Alone System	2005
Wuyang (China)	3,800	6-120	24	Part of Full Mill Supply	2006
JSPL (India)	5,000	6-120	24	Part of Full Mill Supply	2007
Laiwu (China)	4,200	5-100	24	Part of Full Mill Supply	2007
Forges de Clabecq (Belgium)	2,800	5-40	24	Stand-Alone System	2007
Huta Czesochowa (Poland)	3,430	8-120	24	Stand-Alone System	2007

**Recent orders for MULPIC systems received by Siemens VAI**

formability, durability and cost characteristics while, at the same time, providing sufficient tensile strength and fracture toughness.

Modern low-carbon linepipe, with its predominantly bainitic target microstructure, requires high cooling rates and low final temperatures. These are conditions whereby the risk of thermal buckling of the plate is compounded. Small deviations from full surface cooling homogeneity can lead to local distortion. Moreover, the mechanism is unstable so that the distortion further compounds material inhomogeneity. Today's plate mills require a cooling system that cools uniformly as well as intensely. Experience has shown that edges as well as heads and tails require less cooling than the bulk surface if the plate is to remain flat. Plate sizes vary in width. Thus, the engineering of the edge masking is anything but trivial. The same applies to the end masking, which is affected by transient behavior as the surface water layer builds up or dissipates when the plate enters or leaves the system.

#### Highly developed technology

In terms of homogeneity at high cooling rates, the MULPIC system developed by Siemens VAI and CRM is the best performing accelerated cooling system commercially available on the market today. The culmination of long-term engineering and operational refinement in partnership with some of the world's leading steel plate makers, MULPIC systems can be extended

to full direct-quench duty – in other words, to cooling regimes more intense than those normally needed for linepipe production. Direct-quench augmentation brings much of the RQT (roller quench and temper) range of duty into online capability, which is ideal for volume production of wear-resisting steels, for example. Also, MULPIC can be used for products which are less property critical to improve mill productivity by enabling higher finish-rolling temperatures. In yet other cases, MULPIC offers a platform for improving profits by delivering equivalent properties from leaner steel compositions.

#### In a league of its own

This combination of features has made MULPIC the market leader among accelerated cooling systems for plate mills. But maintaining the technical edge as linepipe constructors and operators will require ever more demanding combinations of mechanical properties and pipe stock dimensions. Siemens VAI is proud to provide a technology that underpins the safety and operational efficiency of one of the world's most modern and vital industries. ■

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Reduced coil entry-related downtimes for increased productivity

# High-Productivity Pickling Lines

The length of individual coils in pickling lines, as well as the amount of downtime during coil entry, are factors which can decisively limit the pickling line speed and, thus, line productivity.

Given the fact that the coil length is primarily determined by process and product requirements, solutions for reducing coil entry-related downtime are key for increasing productivity. As a leading supplier of processing lines for the steel industry, Siemens VAI has developed innovative pickling line technologies designed to enable productivity rates of up to 3 million tons per year while, at the same time, upholding high product quality standards.

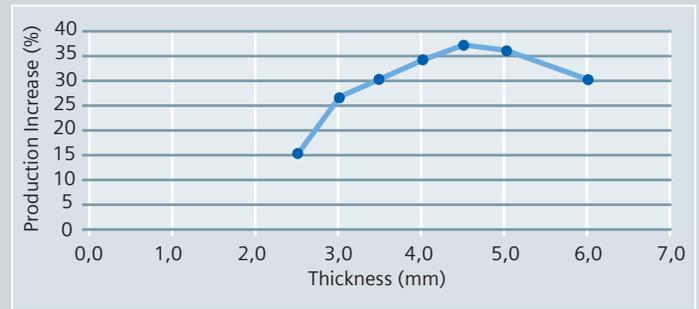
### Conventional coil entry

In conventional pickling lines, downtimes and delays in the coil entry section are generally caused by two consecutively performed groups of operations: strip feeding and positioning in the welder as well as welding operations. Decreasing the average coil entry downtime to below 110 seconds in a pickling line set-up with a conventional design is rather difficult. The following chart provides an overview of the respective time delays for the individual process operations of a conventional pickling line.

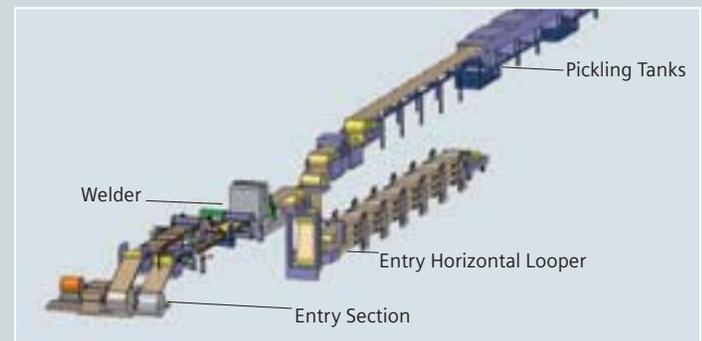
### Improved coil entry section design

The improved coil entry section design of Siemens VAI sees the installation of an intermediate accumulator between the strip handling and welding operations. After alignment of both strip ends, the strips are temporarily joined using a stitcher – a step which is a lot less time consuming than a standard weld. The joined strip is transferred through the first part of the entry accumulator to the main welder, where the strip ends are kept in the welding position. There, the temporary joint is cut and the final weld is carried out. The strip is then transferred to the second part of the entry accumulator and subsequently to the pickling section.

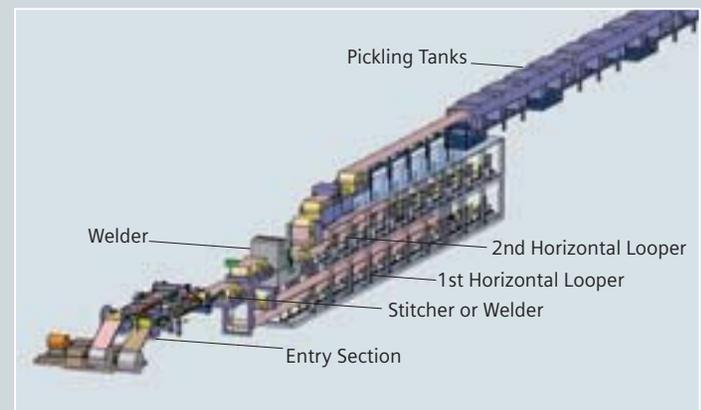
With the new pickling line design, the two main groups of operations – strip head/rail end preparation and welding – can be performed separately, thus leading to considerable time savings during coil entry. In fact, strip entry downtime can be reduced by as much as 50% (from 110 to 55 seconds), with corresponding production increases of nearly 25%, depending on strip thickness. Furthermore, line speed limitations arising in connection with the processing of small coils can be drastically curtailed. This patented solution for achieving significant production increases does not only apply to new high-productivity pickling lines, whether coupled or not, but can also be implemented in existing pickling lines where the entry accumulator is comprised of 2 independent loopers. The described innovative solution is yet another example of a Siemens VAI contribution to improved and more efficient steelmaking operations. ■



**Production increase by reducing the strip-entry downtime from 110 to 55 seconds**



**Design of typical entry section in conventional pickling line**



**Design of entry section in improved pickling line**

### Main Benefits

- Reduction of coil entry downtime by as much as 50% (from 110 to 55 seconds) with corresponding production increase
- High pickling line speeds, even when processing small coils
- Improved correlation of production capacities: pickling and cold-rolling lines with coupled lines

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Three new high-performance foil mills successfully commissioned in Shanghai

# Streamlined Start-Up

Leveraging various proven technology solutions as well as its long-standing commissioning expertise, Siemens VAI supplied Shanghai Shenhua Aluminium Co. Ltd. with three high-performance foil rolling mills located at the KangQiao Industrial Zone in Shanghai, China. The three mills are arranged in the classic roughing, intermediate and finishing mill configuration.

ROLLING & PROCESSING >



The three mills at Shanghai Shenhua are designed to produce in excess of 25,000 tons of thin foil per year, from an entry thickness of 0.6 mm down to a minimum thickness of 5.5 microns. The finished foil products are destined for both domestic and export markets.

## Millstand design

Specifications for the millstand design at Shanghai Shenhua called for various field-proven technologies such as a low friction, double acting roll load cylinder for rolling of low load passes, and an e-block roll bending and balance to eliminate the need for high-pressure disconnections during roll change. The integrated operator- and drive-side work roll latching allows for thermal expansion of the rolls to the operator side,

accommodated by bearing clearances. This eliminates potential thrust forces on the mill spindles as well as work roll bend rams during long passes. Similarly, by accommodating the thermal expansion of the back-up roll through the bearings, potential thrust forces on the roll load cylinder are eliminated. In addition, bearing clearances were specifically designed to tolerate larger bearing expansions. Other integrated features include:

- Off-set positioning cylinders: for both the work roll and back-up roll chocks to create a positive and stable roll off-set, thereby eliminating potential roll crossing and vibration
- Infra red temperature measurement: for the remote monitoring of work roll bearing temperatures
- Pass line height adjustment: an opposed wedge sys-

tem for ensuring pass line accuracy throughout the full range of roll turn-down

- Sideshifting work roll change car: to minimize the time needed for work roll change procedure
- Mill drive: universal spindles with low backlash, along with spindle piloting for positive location of the roll neck in the spindle end to eliminate potential roll vibration

### Automated coil and spool handling

The Shanghai Shenhua mills were also equipped with state-of-the-art coil and spool handling technologies for automated coil handling, automated coil centering and diameter measurement, an automated key alignment system, a combination cone and expanding uncoiler heads, automated spool and scrap coil handling, as well as a foil feeding system.

### Product quality

With respect to product quality, the world-leading process control system of Siemens VAI ensures highest level flatness and thickness performance. The mills at Shanghai Shenhua also feature a broad range of advanced actuators and sensors, among them:

- Shapetech air bearing-type shape roll: the leading sensor for flatness measurement on foil mills due to its low inertia and high sensitivity
- Shapetech integrated solenoid valve (ISV) spray bars: a pulse-width modulated spray system that effectively controls the thermal profile of the work rolls
- Hot-edge sprays (HES): with independent position control, the work roll sprays specifically address edge flatness issues by adjusting the thermal profile of the roll at the strip edge
- Variable crown roll (VC): an advanced actuator that adds another dimension in flatness control with its dynamically adjustable roll crown
- X-ray thickness gauge: offering high-speed, accurate performance with low noise and a large air gap to ease threading

Other product quality-related solutions used to address strip dryness, coil build up and coolant quality involved a strip dryness system, a constant force ironing roll and a Siemens VAI Schneider Roll coolant filter.

### Fast on-site implementation

A fully working model was constructed with the help of the 3D mill design that could be viewed from all sides, and that enabled the monitoring of equipment interfaces and optimization of piping and positioning of devices on the mill. After manufacturing, the equipment was put together in a shop in Europe, where all three mills were fully proof assembled, including the addition of the pipework.

Following the shipment, the investment in 3D modeling and full proof assembly quickly paid off with the erection phase going smoothly and commissioning quickly following the no-load testing.

### Process start-up support

In addition to the design and supply of the three foil mills, Siemens VAI also provided a process support package to start up the mills. Support included experienced Siemens VAI personnel working together with the customer's operators to define operating parameters and offer operation consultation. The commissioning team provided for a fast and successful start-up. The foil



Full proof assembly

roughing mill was the first to be commissioned. Three weeks after the completion of no-load testing, the mill already achieved rolling speeds in excess of 1,700 mpm. The intermediate mill followed a month later with a production capacity of 7 microns within the first week, and shortly thereafter, rolling speeds of 1,800 mpm. The foil finishing mill, which was recently started up, achieved 7 microns within the first week of rolling.

With production build up now well under way on all three mills, and operators gaining experience over a three-shift operation, final acceptance tests for the mills is scheduled for the end of the year. ■

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Entry section with precleaning

Siemens VAI DynaCoater goes on stream at Mittal Steel in Poland

## Superior Coating Solution

A new color-coating line was installed by VAI (now Siemens VAI) at the JSC Magnitogorsk Iron and Steel Works, Russia in 2003 and 2004. Other contracts, including Mittal Steel's new color-coating line in Swietochlowice, Poland, followed in 2005 and 2006. These lines were equipped with the latest equipment and process-control systems to produce color-coated strip of the highest quality standards.

**A** heavy-duty, fully-automatic hydraulic-gauge-control roll coater, known as a DynaCoater, was developed by Siemens VAI for the chemical coating of strip in galvanizing lines as well as for chemical and paint coating in color-coating lines. A major feature of the DynaCoater is servo-hydraulic roll adjustment on the basis of dynamic force control, mak-

ing expensive spindle drives – and their high maintenance costs and slow roll adjustments – a thing of the past. The DynaCoater is characterized by quick reaction times, highest mechanical precision and a unique control system, which can operate in a closed-loop mode on the basis of exact paint-thickness measurements. The highest degree of coating flexibility is essential to the processing of a variety of steel grades with different coating compositions, colors and changing strip dimensions. Special requirements of the construction cladding, roof cladding and household-appliance industries must also be satisfied by the color-coated products. With the DynaCoater, the tightest coating tolerances are achieved using computer-controlled coater settings.

### Worldwide application

In 2004, the first DynaCoater was installed at Magnitogorsk, Russia. Since then, orders have been received from China, Russia and Indonesia.



**Precleaning section with brush section**

At the end of December 2004, Siemens VAI received an order from Mittal Steel in Swietochlowice, Poland, for a color-coating line to process hot-dip galvanized steel and cold-rolled steel. Equipped with the Dyna-Coater, this line painted its first coil on schedule at the end of September 2006. The line now processes strips 0.2–1.2 mm in thickness and 700–1600 mm in width at speeds of up to 120 m/min. Other color-coating line features

### Benefits for Mittal Steel

- Optimized line layout
- Highly-tuned cleaning and pre-treatment
- Dynamic coater control and coater presetting
- Automated program change
- 100% clean air-heated ovens
- Optimized energy balance for ovens
- Integrated quality control system
- Inline paint film thickness gauge
- Scissor-type drum shear

include automatic coil pick-up, height centering and positioning; semi-automatic strip threading with top or bottom coil feeding; hydraulically-operated, high-speed cutting; exact strip-tension control; automatic control of cleaning and rinsing bath concentrations; multi-stage cascade rinsing; flexible catenary-type ovens; hot lamination of decorative and protective film; and exact alignment of coiled strip edges.

#### Quick ramp-up

Thanks to this high-performance color-coating line,

Mittal Steel is now in an excellent position to increase its production of color-coated strip material by 100,000 t/a while becoming one of the most efficient plants of



**The successful start-up team with the first painted product of the new color-coating line of Mittal Steel Poland**

### Mittal Steel awarded Siemens VAI Linz the Cold Commissioning Certificate for their new color-coating line

On September 27, 2006, the first coil was painted successfully in the new color-coating line of Mittal Steel Poland at its Swietochlowice works, and subsequently signed the "Cold Commissioning Certificate."

A delegation from Mittal Steel Poland and Arcelor were impressed by the new line during their visit on the "First Paint" day.

After the successful completion of the cold commissioning phase, the hot commissioning phase with the performance tests was also executed in a very short period of two months. With this project, Siemens VAI demonstrated again a professional project execution.

Many thanks to the erection and start-up team of Siemens VAI, VAI Polska and all of the colleagues in Linz and Prague for their contribution to this success.

its kind in Europe. Advanced engineering tools and the involvement of an experienced project management team were the basis for a successful project outcome and the quick ramp-up to production at the Mittal facility in Swietochlowice. ■

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Advanced industrial machinery and mechatronics manufacturing

# A Commitment to Excellence

The Montbrison workshop of the Siemens VAI group has been a partner for the metallurgical industry since 1913. Montbrison focuses on the production of rolling and processing equipment as well as special components. The wide-ranging capabilities of this competence center are outlined in this article.

**A**t Montbrison, located some 50 kilometers from the Siemens VAI France office in St. Chamond, a 19,000 m<sup>2</sup> covered workshop is dedicated to the manufacture, assembly and testing of equipment and specialized components primarily for the steel rolling and processing industry. The workshop facilities include 14 cranes (with 5 to 150-t lifting capacity) and 20 machine tools, of which 14 are computer-aided and directly linked to CAD tools such as Solidedge 3D and Unigraphics CAM +.

During the past two years, the Montbrison workshop has expanded its manufacturing excellence to include laser welders, tension levelers and scale breakers. More than 200 major technological components, including AGC (automatic gauge control) cylinders, special equipment such as tension levelers, scale brakers and carousel coilers have been manufactured at this site. Customers include Michelin and Airbus S.A.S.

## Pre-assembly and testing

Extensive equipment resources, automation specialists and a well-staffed engineering office ensure smooth project execution and short start-up times. Activities focus on the following:

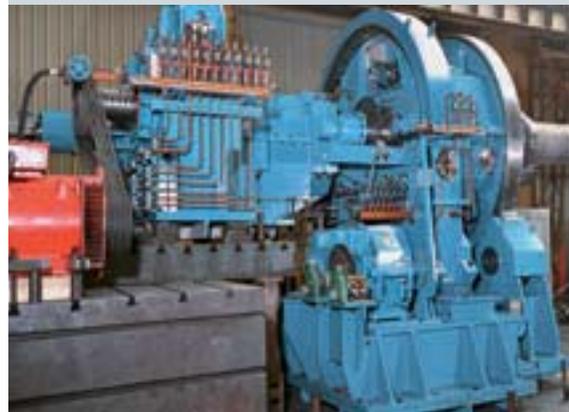
- Construction of welded steel assemblies, including gamma and ultrasonic material checking
- Machining of high-yield strength alloyed-steel components for Siemens VAI special equipment
- Equipment assembly and pipe work under the supervision of dedicated specialists
- In-house testing to minimize onsite equipment tuning; comprehensive testing facilities are particularly important for achieving superior equipment performance and include:
  - Stands for pressure tests on AGC roll-force cylinders
  - Stands for pressure and load tests for hydraulic bending and shifting blocks

- Pilot rolling mill
- Hardware and software for the monitoring and evaluation of complex test results

The tests are executed according to predefined procedures and are systematically documented to increase the overall quality of the entire process chain from engineering to system installation.



Manufacture of a hot-coiler mandrel for Mittal Steel with the new combined planomill and vertical lathe machining center



Carousel coiler, Tangshan Iron & Steel Group Co Ltd.





Roughing Mill Edger,  
Erdemir, Turkey

### Equipment excellence and life-cycle service expertise

Backed by such extensive resources, Montbrison is a major player within Siemens VAI for the execution, tuning and industrialization of equipment prototypes (e.g., carousel coilers). What is more, Montbrison provides customers with expertise and competence for:

- Onsite engineering and in-house reconditioning of mandrels, hydraulic roll-force cylinders, etc.
- Off-line maintenance, including temporary equipment substitutions while defective items are under repair at Montbrison
- Work supervision during scheduled downtimes
- Troubleshooting in the event of malfunctions
- Upgrades to increase equipment service life

### Certified quality and safety

Permanent upgrading of performance to the complete satisfaction of customers and vendors is a hallmark of the Montbrison workshop. Following the ISO 9001 2000 and EN 9100 certification milestones, Montbrison has undertaken a continuous improvement and performance upgrade approach that includes benchmarking and implementation of the 5S method (\*). Montbrison is now in the position to meet growing customer requirements by identifying and quantifying the risks and hazards associated with advanced manufacturing. Preventative action is regularly undertaken toward achieving the goal of zero risk. A further goal is the achievement of ISO 14000 certification by the end of February 2007.

With the achievement of these milestones in mind, Montbrison is permanently developing and improving its expertise and capabilities to continue delivering best-practice performance for every one of its partners. ■

### Examples of special equipment manufactured at Montbrison during the past two years

- 9 DAK® (dynamic air knife) systems
- 7 Skin-pass mills
- 21 Welding machines
- 6 Planicim® shapemeters
- 27 Tension levelers
- 5 Scale breakers
- 93 AGC cylinders
- 19 Mandrels
- 80 Hydraulic blocks
- 2 Carousel coilers

(\* )The 5S method is a structured program to implement workplace organization and standardization. The 5S system, developed in Japan, improves safety, work efficiency, productivity and establishes a sense of ownership.

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Siemens Mining Technologies (I&S MT MI) delivers water solutions specifically designed for the mining industry

# Best Brands in Water Treatment

Siemens Water Technologies was born through the integration of USFilter into Siemens Industrial Solutions and Services (I&S) in 2004, and incorporates some of the best known technologies in the water treatment industry. Siemens I&S provides solutions covering all aspects of the water cycle, from industrial process water to municipal drinking water and wastewater treatment.

**T**he sheer breadth of technologies and services available within Siemens has presented the water industry with a unique supplier able to deliver the most technologically advanced and cost-effective solutions. Siemens continuously evaluates the suitability of a technology based on functionality as well as capital, operating and installation costs. This ability to review and design focused solutions,

and not simply advocate a single solution, is what sets Siemens I&S apart from its competitors in the industry.

## Meeting the needs of the mining industry

As mining industry sites continue to expand into remote locations, developers are faced with the challenge of minimizing the impact on the local environment. Large volumes of water are produced from drainage and run-



## Ultra-high recovery in integrated membrane systems for mine water treatment

Siemens provides a variety of state-of-the-art pretreatment technologies that can be selected according to the incoming feed water chemistry and the target water quality required to feed a reverse osmosis (RO) system.

The Trident® HS system offers four barriers of treatment protection. This innovation allows the system to handle very high raw water turbidity and solids loading, including iron and organics, while maintaining high-quality and low SDI feed to the RO.

Memcor® membrane ultrafiltration systems provide a verifiable barrier to assure removal of turbidity and suspended solids from the feed stream, providing RO systems with ultra-low SDI.

The high-quality feed stream to the RO system enables it to operate at levels from 75 to 90% recovery with limited downtime for membrane cleaning. 10 to 25% of the initial volume remains as a concentrated solution, and requires further volume reduction.

The patented Memtek® microfiltration membrane softening process treats the concentrated waste stream, enabling it to be returned to an RO system for final volume reduction.

off at the sites, and contain contaminants ranging from heavy metals to selenium and to chlorides.

Historically, Siemens has provided equipment-based solutions centered on technologies such as clarifiers, thickeners and filter presses. More recently, technologies and services focusing around membrane filtration have been added that are designed to meet the continuous changes in environmental regulations, which have resulted in customers demanding a more solutions-oriented approach. The Siemens value proposition now lies in providing complete, high-quality process solutions from start to finish.

### Leveraging expertise to meet the demands of different regions

Because the Siemens name is synonymous with quality around the world, demand remains strong from various regions. Regional requirements differ with respect to discharge regulations, availability of water, overall climate and the demand for service and operating contracts. North America, for example, is more apt to require a service contract with the technology, whereas other geographies generally opt for technology alone.

By working with Siemens Mining Technologies (I&S MT MI) as a single-source supplier for the entire water system, mining customers from different regions save

time and money, and are able to be up and running faster under a single process warranty. Capacities for these systems range from a few hundred gallons per minute to many thousands of gallons. The overall volume reduction of the waste streams ranges from 98 to 99%, depending on the components of the incoming water.

With the high price of commodities, customers are increasingly looking for fast-track solutions. The quicker they complete a new mine or processing operation and get the product to market, the sooner they are able to realize earnings on their investment. A single supplier with multiple integrated solutions such as Siemens enables the customer to streamline the building and procurement process, and to take advantage of synergy savings. Equally important, customers prefer working with companies that are based in the same geographical area and that understand the local cultural and environmental challenges. As a global company with strong local capabilities, Siemens understands these requirements and is able to meet them – whenever and wherever they arise. ■

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## Increased safety with the automatic gas-coupling system

# Safety First!

Innovation in the steel industry is driven by ever increasing demands for productivity, quality improvements and cost reductions. Security considerations, however, no longer take a back seat to production targets. The field-proven automatic gas coupling system of Siemens VAI offers a practicable and efficient solution, not only for increased personnel safety in the steel shop, but also for achieving higher productivity.

SERVICES &gt;



**T**he automatic gas-coupling system is a reliable, safe and maintenance-friendly device for connecting the stirring gas supply to a steel ladle. The system is immediately and automatically activated upon insertion of the ladle into the ladle station or onto a transfer car. No personnel whatsoever are required for connecting hoses to the supply source. The gas flow is regulated by the operators from a safe distance. The system is designed to withstand high dust loads and high temperatures, and also compensates for any ladle misalignments.

### Simple connection

The automatic gas-coupling system consists of two main components: a lower unit mounted on the ladle station, as well as an upper unit attached to the ladle. When the ladle is lowered into the ladle station or onto a ladle car, the upper and lower components automatically connect through the weight of the ladle. There is no need for additional sealings or operator interaction.

### Possible gas-coupling arrangements

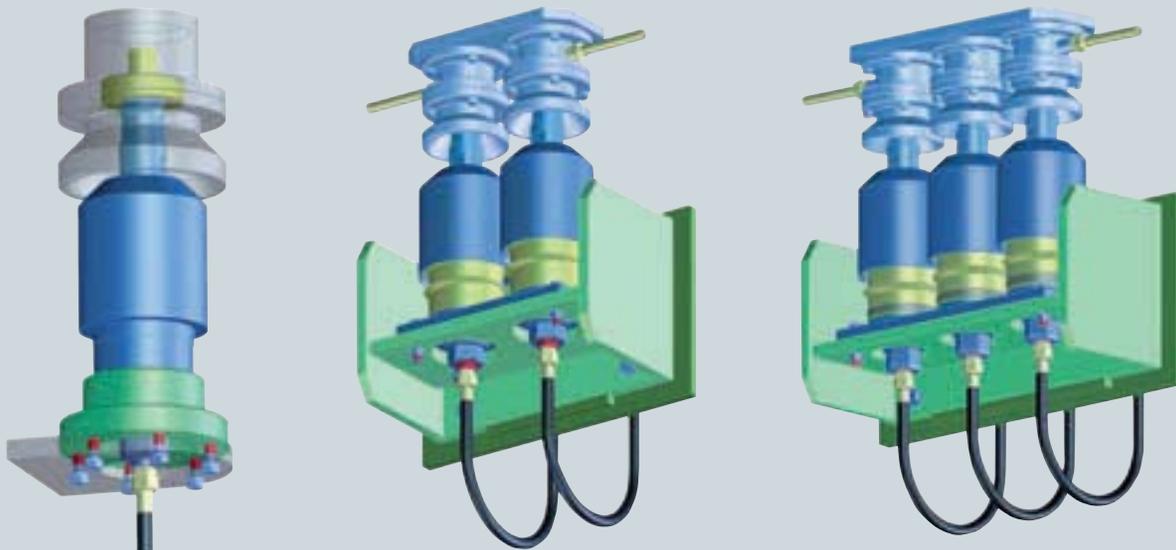
The automatic gas-coupling system is available in four different versions:

- Single coupling type V-GCV 11 for a single gas line
- Single coupling type V-GCV 10 compact version
- Double coupling type V-GCV 20 for two gas lines
- Triple coupling type V-GCV 30 for three gas lines

The multiple gas-line systems enable independent gas supply to two or three porous plugs on the ladle bottom, even with different gas pressures. Simultaneous use of two different gases is also possible. When used in combination with a Siemens VAI gas control unit, gas flow is completely regulated from either a main control pulpit or from a local pulpit.

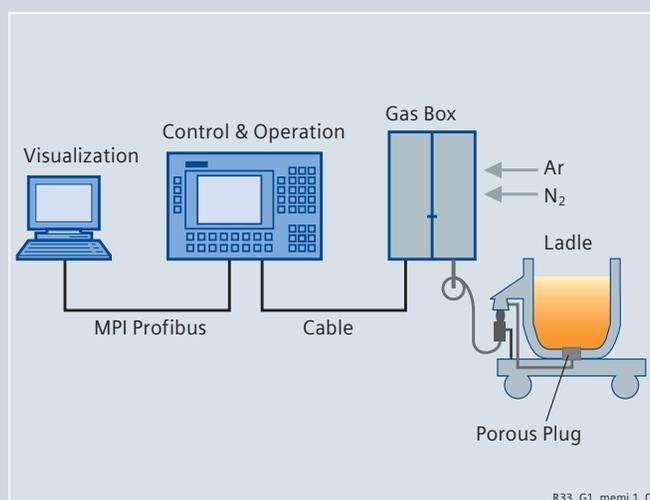
### System advantages

The automatic gas-coupling system of Siemens VAI offers numerous advantages: first and foremost, in-



Typical arrangements of single and multiple gas-line couplings

Main design features	
Single coupling type	V-GCV 11: for a single gas line V-GCV 10: compact version
Double coupling type	V-GCV 20: for two gas lines
Triple coupling type	V-GCV 30: for three gas lines
Stirring gas	Argon or nitrogen
Working pressure	Up to 25 bar
Flow rate per line	Up to 2,500 l/min (STP)
Positioning tolerances	Horizontal direction: +/- 50 mm (+/- 70 mm for V-GCV 11 version) Vertical direction: +/- 25 mm (+/- 40 mm for V-GCV 11 version)



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Principle system arrangement of automatic gas-coupling system

creased security for operational personnel, which is no longer required to work in the ladle station area. Stirring gas connections to the ladle are carried out fully automatically. Connection of the stirring gas supply is also performed quickly, safely and fully automatically when the ladle is placed into the ladle station. The system requires no hydraulic or electrical facilities of any kind. Moreover, the system is designed so as to compensate for ladle positioning misalignments of up to 50 mm in the horizontal direction (70 mm for the V-GCV 11 version) when inserted into the ladle stand or onto a ladle car.

As a highly compact unit, the automatic gas coupling system can be easily installed, also in areas with limited space. It can withstand temperatures of up to 500 °C, thereby even enabling high temperature applications such as VOD (vacuum oxygen decarburization).

Also, the simple and sturdy design of the connecting system helps to reduce maintenance tasks, keeping servicing to an absolute minimum.

### Increased safety in the steel shop

The Siemens VAI automatic gas coupling system marks an important step toward providing increased safety in the steel shop. The presence of operational personnel in hazardous working areas for connecting gas lines to steel ladles is therefore no longer necessary. What is more, the system can be implemented with a minimum of installation effort and at a reasonable expense.

Since 1991, a total of over 50 automatic gas-coupling systems have been sold to 26 customers in 16 countries for metallurgical vessels of all types, including LD (BOF) converters, electric arc furnaces, ladle-treatment stations, ladle furnaces and vacuum-degassing plants. ■

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Service support is just a phone call away

## ‘Round the Clock, ‘Round the Globe

On October 1, 2006, Siemens VAI launched its Metals/Mining Service&Support Center (MSC). The center serves as the single point of contact of the Siemens VAI global network for all metallurgical and mining-related customer service needs anywhere in the world.

**A**t the newly established Metals/Mining Service&Support Center, customer requests and inquiries are tracked at a help desk where service managers with specialized know-how are on hand to provide immediate expert service support. An e-mail portal is provided for all customers, and dedicated phone lines are available for “premium customers” 24 hours a day, 7 days a week and 365 days a year. The staff at the MSC is backed by a highly skilled team of commissioning engineers and development specialists from a wide variety of fields located throughout the world. Service managers at the help desk immediately process requests and respond within the contractually agreed response times. They are also responsible for coordinating local and central sup-

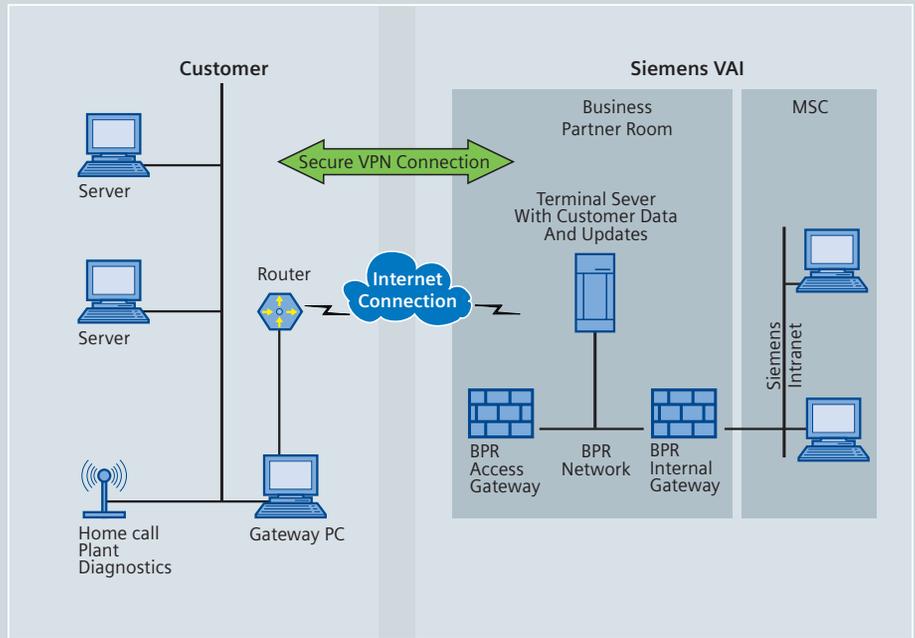
port centers, which are available to all customers. In addition, the MSC also serves as a customer service platform for frequently asked questions.

### Remote service support

MSC staff is able to provide remote plant assistance in the form of “hands-on” online support (via the so-called Business Partner Room). In addition, they handle the storage and retrieval of service-relevant project data, software package updates (e.g., patches and hot fixes), as well as the preparation and installation of migration packages for system platforms. Tested software updates include updates for automation platforms, plant product updates, plant documentation updates and antivirus software updates.

## Main Benefits

- Maximum plant availability
- Dedicated input channel for all requests
- Fast response with the appropriate solution for any plant-related problems
- Software updates in dedicated customer Web sites
- Access to optimization tools for improving plant performance based on actual plant data
- Optimized spare parts management



Monitoring and evaluation of data can be carried out remotely via secure VPN connections

Furthermore, submission of spare parts reports (according to the tracking system of the installed base) is performed via the Business Partner Room.

The monitoring and evaluation of plant performance-related data, including the implementation of necessary changes, can be remotely carried out with the explicit authorization of the customer. All online connections (VPN connections) are secure and fully compliant with highest security and confidentiality mandates and policies. Remote communication can be further facilitated through the use of special audio/video transmission tools, offering customers additional service support options such as remote visual analysis of problems, remote instructions, remote supervision as well as telecollaboration between local engineers and headquarter specialists.

### Additional service offers

Documentation services are available for new plants, allowing the customer to access, for example, technical drawings and equipment specifications from a central onsite Web server. Plant documentation can also be managed and kept up-to-date by Siemens VAI. The system is Web-based and independent of the software tools used for documentation. The functionality includes the following features:

- Search engine for data retrieval and hyperlinks for intuitive navigation through the documentation (in CAD/software schematics and also in PDF files)

- Connection to alarm logging (WinCC)
- Context-sensitive navigation between HMI (human machine interface) masks (WinCC) and plant documentation
- Bi-directional navigation between CAD schematics (hardware) and PCS 7 CFC diagrams (software)

Spare parts management is also included in the MSC service support portfolio and comprises everything from stock analysis to stock optimization.

### Maximum plant availability

The comprehensive service support contracts of Siemens VAI offer customers a wide spectrum of valuable benefits for enhancing plant performance. Event management tools continuously monitor the automation system status to provide just-in-time response and prevent potential failures before they occur. Through the combination of all of these solutions, the ultimate target of maximum plant availability can be achieved. ■

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## The Queen's Award for International Trade

On August 2, 2006, the Dorset/UK-based Shape Technology Ltd (a subsidiary of Siemens VAI Metals Technologies Ltd/UK) was among the recipients of the most prestigious award granted to business companies in the UK.

Shape Technology supplies shape and profile measurement equipment and associated products to the metals industry worldwide. "We are extremely proud to be recognized as a winner of a Queen's Award. It is internationally recognized as a symbol of success," Malcolm Jenkins, managing director of Shape Technology, acknowledges.

Dr. Peter Spooner, Malcolm Jenkins and Claire Bustin-Weir represented Shape Technology at a reception hosted by The Queen and The Duke of Edinburgh at Buckingham Palace on July 10, 2006.

The Queen's Award for International Trade is bestowed by The Queen each year to exceptional companies which have demonstrated substantial growth in overseas earnings and commercial success. Shape



**HRH Queen Elizabeth II and The Duke of Edinburgh meet Dr. Peter Spooner (chairman), Claire Bustin-Weir and Malcolm Jenkins (managing director) of Shape Technology Ltd, UK**

Technology, as a recipient of the award in 2006, ranks as one of the UK's most successful companies. ■

## Conference in Vancouver

The fifth international conference on "Autogenous and Semiautogenous Grinding Technology" was held in Vancouver, Canada from September 23 to 27. The conference is the most important conference in the grinding industry, and has been organized since 1989 by the Department of Mining Engineering, University of BC, the Canadian Mineral Processors Division of CIM and the Canadian Mining Industry Research Organization.

Kurt Tischler, Siemens VAI product manager for gearless drives, held a lecture in front of approximately 540 participants on "The Operation Modes of a Grinding Mill with Gearless Drive." Operators, experts, consultants as well as members of universities and suppliers from all over the world took part in the conference. A total of 116 lectures were held during the four days.

An international advisory committee supports the organizing parties. Norbert Becker, Siemens VAI product family manager, has been a member of the committee since September 2004. ■

## Yellow Crane Friendship Award

The city of Wuhan, China awarded the "Yellow Crane Friendship Award" to Bernhard Scholz of Siemens VAI for his successful work at the Wuhan Iron and Steel Corporation (Wisco). His first task at Wisco in 2000 was to oversee a building project for the first cold

rolling line. At the moment, he is responsible for all works on the second cold rolling line, which is expected to be completed by the end of this year. This line will enable Wisco to produce steels of higher quality for automotive or consumer good applications. Moreover, the new line will also increase company competitiveness.

Over the past 35 years, Scholz has worked on more than 20 projects. This wealth of experience has contributed significantly to the efficient and trouble-free commissioning of the new plants at Wisco. ■



**Bernhard Scholz (left) was given an award for his commitment at Wisco**

## More information

You can find further information and more press releases over our online portal at [www.siemens-vai.com](http://www.siemens-vai.com)

# Ludwig von Bogdandy Prize

On September 14, 2006, Dr. Zulfiadi Zulhan was awarded the prestigious Ludwig von Bogdandy Prize of the RWTH Aachen University, Germany for his outstanding achievements in the field of ferrous metallurgy.

Following completion of the bachelor's and master's degrees in Indonesia, Zulfiadi Zulhan received his doctorate from the RWTH (Rheinisch-Westfälischen Technischen Hochschule) Aachen University in June 2006. His thesis focused on the question of whether the type and quality of pulverized coal injected into an electric arc furnace had an impact on the formation of foamy slag, an important factor in electric steelmaking operations for energy efficiency, prolonged refractory lifetime and shorter tap-to-tap times. On the basis of his work, which provided considerable insights into this highly relevant and important topic, he received the Ludwig von Bogdandy Prize on the occasion of the Aachen Steel Colloquium (ASK).

Dr. Zulfiadi Zulhan has been employed as a metallurgist at Siemens VAI Metals Technologies GmbH in Duisburg, Germany since March 2006. ■



**Award ceremony (from left to right): Dr. Zulfiadi Zulhan, Professor Dr. Dieter Senk, Professor Dr. Wolfgang Bleck, RWTH Aachen University, Germany**

# Inventor of the Year

Each year since 1994, Siemens has honored twelve of its employees who have made substantial contributions toward the technological competence and the economic success of the company. On December 4, 2006, Dr. Johannes L. Schenk received the "Inventor of the Year" award in Munich, Germany for his work toward improving the efficiency of the Finex process.

Dr. Schenk received the award for his extensive invention activities and for recognizing – together with others – that a considerable portion of the top gas could be reused in the Finex process to improve overall production efficiency. Furthermore, the high temperatures prevailing in the melter gasifier of a Finex facility can be better controlled, resulting in an improvement of the hot metal quality with respect to the contents of silicon and carbon.

Dr. Johannes L. Schenk can look back on 32 inventions in the field of ironmaking technology. Together with his colleagues, work continues on further improving the process parameters of this milestone technology. "Innovation is hard work, and an idea is only the first step of a long journey," says Schenk. ■



**Dr. Johannes L. Schenk, Finex project manager**

## More information

You can find further information and more press releases over our online portal at [www.siemens-vai.com](http://www.siemens-vai.com)

Africa's premier mining, construction, industrial and electrical show, the Electra Mining, was held between September 11 and 15 at the Nasrec Expo Centre in Johannesburg, South Africa.

Electra Mining Africa is the second biggest mining and industrial show worldwide and one of the best of its kind internationally, making it a strong catalyst for new investment opportunities in the mining industry. It is also the gateway to Africa for investors around the world. The exhibition provided Siemens the perfect opportunity to showcase

## Electra Mining 2006

its latest technology for the mining industry, and to meet with the people in the buying

chain to discuss their needs and challenges face-to-face.

Over the five day exhibition, Siemens clearly demonstrated its in-depth understanding of the mining process and ability to integrate automation and drive technology, power supply, security systems, IT and technological process controls to form customized solutions – thereby ensuring the maximum benefit to its customers over the entire life cycle – from planning to modernization. ■

## Events: Upcoming Conferences and Fairs

- |                    |  |                    |   |
|--------------------|--|--------------------|---|
| <b>MAR 1 – 2</b>   | STAHLMARKT, Düsseldorf, Germany<br><a href="http://www.handelsblatt.com">http://www.handelsblatt.com</a>   | <b>MAY 7 – 10</b>  | AISTECH 2007 (AIST), Indianapolis, Indianapolis Convention Center   |
| <b>MAR 4 – 6</b>   | 13th WORLD STEEL CONFERENCE (CRU), Bonn, Grand Hotel Petersberg<br><a href="http://www.cruevents.com">http://www.cruevents.com</a>   | <b>MAY 8 – 11</b>  | 8th INT. TRADE EXHIBITION OF MACHINE MANUFACTURING & WELDING TECHNOLOGY (machtech), Budapest, Fair Center<br><a href="http://www.hungexpo.hu">http://www.hungexpo.hu</a>                                      |
| <b>MAR 5 – 7</b>   | 13th BAUXITE & ALUMINA SEMINAR (MB), Athens, Hotel Bretagne<br><a href="http://www.metalbulletin.com/events">http://www.metalbulletin.com/events</a>   | <b>MAY 10 – 12</b> | 14th SHANGHAI INT. METALLURGY EXPO/SHANGHAI STEEL TUBE EXPO (Shanghai Society for Metals), Shanghai, Int. Exhibition Center<br><a href="http://www.metal1986.com/">http://www.metal1986.com/</a>              |
| <b>MAR 8 – 9</b>   | ASK UMFORMTECHNIK DER ZUKUNFT FORM GEBEN (RWTH), Aachen, Europasaal Eurogress 22.<br><a href="http://www.ibf.rwth-aachen.de">http://www.ibf.rwth-aachen.de</a>   | <b>MAY 15 – 17</b> | WORLD MINING CONGRESS (Terrapinn)<br><a href="http://www.worldminingcongress.com">http://www.worldminingcongress.com</a>  |
| <b>MAR 12 – 14</b> | ARAB STEEL SUMMIT 2007 (AISU), Muscat City, Oman<br><a href="http://www.arabsteel.info/events/Summit2007/asse2007.asp">http://www.arabsteel.info/events/Summit2007/asse2007.asp</a>  | <b>MAY 18 – 20</b> | 3rd CHINA INTERNATIONAL METALS INDUSTRY FAIR – METALS FAIR (MC-CCPIT), Guangzhou, Guangzhou International Convention & Exhibition Center<br><a href="http://www.metalsfair.com">http://www.metalsfair.com</a> |
| <b>MAR 13 – 15</b> | CARBON MARKET INSIGHTS 2007 (Pointcarbon), Copenhagen<br><a href="http://www.pointcarbon.com">http://www.pointcarbon.com</a>   | <b>MAY 28 – 30</b> | THE INT. WIRE & CABLE TRADE FAIR (Messe Düsseldorf), Moskau, Krasnaja Presnja<br><a href="http://www.event-info@messe-duesseldorf.de">http://www.event-info@messe-duesseldorf.de</a>                          |
| <b>MAR 20 – 23</b> | AMERICANA 2007 – (Réseau-Environment), Quebec, Montreal Convention Centre<br><a href="http://portal.wko.at/wk/format_detail.wk?AngID=1&amp;StID=273938">http://portal.wko.at/wk/format_detail.wk?AngID=1&amp;StID=273938</a> | <b>MAY 28 – 30</b> | METALLURGY – LITMASH, TUBE, ALUMINIUM/NON-FERROUS (Messe Düsseldorf), Moskau, Krasnaja Presnja<br><a href="http://www.event-info@messe-duesseldorf.de">http://www.event-info@messe-duesseldorf.de</a>         |
| <b>MAR 22 – 24</b> | 2nd MADE IN STEEL CONFERENCE, Brescia, Brixia Expo<br><a href="http://madeinsteel.it/news.php">http://madeinsteel.it/news.php</a>  | <b>JUN 4 – 6</b>   | CLEAN STEEL 7, Balatonfüred<br><a href="http://www.mvae.hu/cleansteel">http://www.mvae.hu/cleansteel</a>  |
| <b>MAR 27 – 30</b> | 3rd ANNUAL ASIA MINING CONGRESS (Terrapinn), Singapore, The Grand Hyatt<br><a href="http://www.terrapinn.com/2007/asiamining">http://www.terrapinn.com/2007/asiamining</a>   | <b>JUN 10 – 14</b> | 2nd INT. CONFERENCE ARCHAEO-METALLURGY IN EUROPE (AIM), Grado<br><a href="http://www.aimnet.it/archaeometallurgy2.htm">http://www.aimnet.it/archaeometallurgy2.htm</a>  |
| <b>APR 22 – 24</b> | ALUMEX 2007 – 4th MIDDLE EAST ALUMINIUM METAL & METALLURGY EXHIBITION (Metef), Dubai, Dubai International Convention Center<br><a href="http://www.alumexdubai.com">http://www.alumexdubai.com</a>                           | <b>JUN 11 – 13</b> | 11th WORLD ALUMINIUM CONFERENCE (CRU), Montreal, Hotel Omni Mont-Royal<br><a href="http://www.CRUMonitor.com">http://www.CRUMonitor.com</a>   |
| <b>APR 24 – 26</b> | MINING WORLD RUSSIA 2007 – 11th INT. EXHIBITION FOR MINING & PROCESSING OF METALS & MINERALS, Moscow, Crocus Expo  | <b>JUN 12 – 16</b> | METEC InSteelCon 2007 (VDEh)Düsseldorf, Congress Center Düsseldorf<br><a href="http://www.stahl-online.de">http://www.stahl-online.de</a>   |

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