

POSCO E&C has been stepping forward to be one of the world's leading companies in the area of iron making. Recent blow-in at India's largest blast furnace proves POSCO E&C's technology which shall ultimately benefit our clients from high productivity and low operating cost.



India SAIL-IISCO New Blast Furnace

**POSCO E&C Lights Up India's Largest Blast Furnace**



**20th R&D Conference for Great Steel Technologies Held**



**Convincing Slab Quality by Its Own Engineering Knowhow**



**Expand Your Horizon With PEPCOM Solution**



## POSCO E&C Lights Up India's Largest Blast Furnace



POSCO E&C has set a new dawn with the 'blow-in' of the country's largest blast furnace in the early hour of 1<sup>st</sup> December, 2014.

Earlier, India's largest capacity blast furnace belonged to the Rourkela steel plant. Now, however, this new furnace with a volume of 4,160 cubic meters and 2,700,000 ton annual production has become the biggest operating blast furnace in India. "With this, IISCO Steel Plant is firmly on the course to regain its glorious past." SAIL Chariman C.S.

Verma said after the "blow-in".

This massive EPC Turn-Key project was delivered by consortium of POSCO E&C and NCC. The consortium is led by POSCO E&C with work scope of engineering, procurement and commissioning while NCC was in charge of construction work.

The majority of construction materials and equipment were procured domestically. This includes the entire 18,000 tons of steel structure, 35,000 tons of refractories and 18 mechanical

packages of pumps, valves, etc. This sourcing strategy with quality management led to significant costs reductions.

Further, the commissioning of the project was successfully executed with the combined technical expertise of the POSCO group companies. 50 of technicians, consultants of POSCO E&C attended and assisted the blow-in.

"We expect to get the first slag from the furnace within 30 hours of the blow-in. So far, all systems and processes have been functioning well," an IISCO official from the development department said.

POSCO E&C is receiving wide acknowledgement from SAIL executives and employees for its excellent blast furnace blowing operations and quality in construction. Now it is planned to deliver hands-on experience to the SAIL's operators which is a great help to see the machine actually in this start-up stage and to understand how it works.

## Convincing Slab Quality by Its Own Engineering Knowhow Completion of Gwangyang Steelmaking and Hot Rolling Plant



Recently, POSCO E&C has successfully completed a hot run test at steelmaking and continuous casting plants of Gwangyang No.4 Hot strip mill. POSCO E&C

supplied optimized equipment based on its own engineering and accumulated O&M know-hows.

Through the completion, the hot strip mill plant would be supplied with a stable amount of slabs to produce 3.3 million tons of flat products annually. Most of the products will be provided to global car manufacturers through POSCO's overseas branch offices.

In this plant, one 280 T/H converter was provided and a set of RH and LF were installed for secondary refining process. The RH equipment is specially designed to assist producing high-end flat products. In addition, two vertical type casting machines were newly installed.

With all above together, POSCO E&C has guaranteed the quality of the slabs by the shop test and on-line installation right after the fabrications of all equipment. This unique project experience is expected to be applicable to the future projects.

## Selected As The Preferred EPC Contractor of Coal Terminal, Australia

On 15<sup>th</sup> December, Adani Mining Pty Ltd announced that they nominated POSCO E&C as the preferred EPC contractor for the coal handling facilities and export port construction project called "Terminal Zero" amounting to AUD 1 billion.

Previously, POSCO E&C was already selected as the EPC preferred bidder for the with 388 km length railway project connecting between Carmichael mine in Queensland and Abbot Point port, which amounts to AUD 2 billion.

This Adani Coal Terminal Zero port is the first investment project of Adani Group in Australia, which will play an important role of the high quality coal export to Asian countries. Also, Adani group plans the port with the export capacity from 40 million tons per annum in the first phase to 70 million tons per annum by stages.

Adani's Australian country head and mining chief executive Mr. Janakaraj said, "This is the latest announcement that brings our integrated mine, rail and port project closer to first coal production in 2017. POSCO E&C is a proven and trusted business partner who operates stable EPC business worldwide, and we welcome this valuable opportunity to enhance our cooperation with them."

As an equity participant as well, POSCO E&C enhanced the viability of the project and now expects that this agreement will expedite the first coal export planned in 2017.

## 20<sup>th</sup> R&D Conference for Great Steel Technologies Held



On 26<sup>th</sup> November 2014, POSCO E&C held the R&D conference which

is one of the biggest annual events of the company. For this year, as the 20<sup>th</sup> anniversary of R&D conference, 45 steel technologies of the company were introduced to the audience. During the steel technology session, which encompassed upstream and downstream technologies, the participants had vigorous discussion on recent research paper.

Especially, attendees gave a prime focus on the newly introduced technology report in steel sector. Optimum Design of Converter, as the one of the newly introduced technologies this year, is very important from the practical point of view.

In this cover, a brief of this new technology is summarized for reader's understanding.

## Flammability limits of off gas (CO-H<sub>2</sub>-H<sub>2</sub>O-CO<sub>2</sub>-N<sub>2</sub> mixtures at elevated temperatures) and pressure raise rate in case of deflagration inside of Electrostatic Precipitator (ESP)



Figure. 1 Site overview of Gwangyang No.4 Hot Strip Mill Plant Project, POSCO (steel making plant)

This technology is aimed at facilitating the refining process of molten iron into a steel product as required. Currently, this has been applied to several facilities in the steel making plant based on its engineering result.

The refining process is to reduce the amount of carbon contained from 4~5% to less than 0.1% as well as controlling the impurities and increasing the temperature of the tapped steel made from scrap and hot metal over 1,650 °C. A typical cycle time (tap-to-tap time) is 45 minutes approximately. The time range varies between 30 to 60 minutes depending on its operation condition.

This study of experimental evaluation of the flammability limits and fundamental burning properties is conducted in steelmaking plants where off gas treatment systems are installed and a high temperature gas mixture of H<sub>2</sub>, O<sub>2</sub>, CO, CO<sub>2</sub>, N<sub>2</sub> and inert dust particles are emitted.

During de-carburization period, the high initial temperature (800 ~ 1,000 °C) of this mixture is reduced by injection of mist (steam + water) and coarse dust particles are collected inside the EC

(evaporation cooler). To separate fine dust particles from the gas phase after EC (evaporation cooler), an electrostatic precipitator [ESP] is proven to be an efficient method. The normal range of gas temperatures for the ESP should be maintained between 170°C to 250°C, so that the multi component gas mixture could contain high steam content.

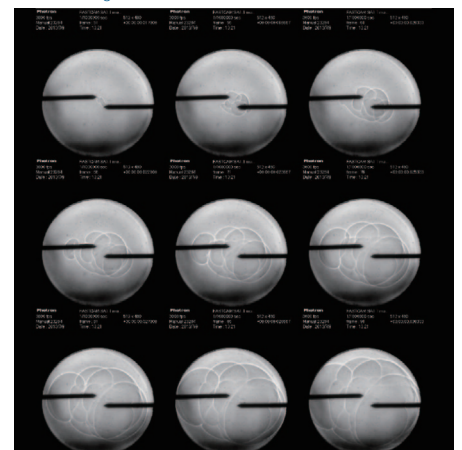
Under the normal operation conditions, combustible mixtures should be excluded by eliminating oxygen contained in the process gas. In case of process disturbance, however, reactive CO-H<sub>2</sub>-O<sub>2</sub> mixtures could be developed inside the ESP and due to the high voltage used for charging dust particles, an ignition might not be excluded properly.

For the safety design of the ESP vessel and an effective vessel venting system, the knowledge of the flammability limits and maximum pressure rise rates of the multi component gas mixture at elevated temperatures is highly required. Despite of its importance, only few studies about flammability of CO-H<sub>2</sub> mixtures were found in the literature.

The main purpose of this study is to perform the experimental investigation on the important combustion characteristics for ESP relevant (CO+H<sub>2</sub>-O<sub>2</sub>-(H<sub>2</sub>O+CO<sub>2</sub>+N<sub>2</sub>) gas mixtures at temperatures from 170 to 250°C and atmospheric pressure conditions in a spherical explosion chamber. To investigate the flammability limits and pressure rise rates of multi component mixtures, a spherical stainless steel explosion bomb was adopted. The bomb has two quartz windows for optical observations as well as ports for two pressure gauges and thermocouples to record pressure and temperature during the combustion process.

To synchronize the conditions of experiment with actual operation condition, the ignition device and its energy release are the most important factor for the measurement of flammability limits. The accurate

Figure. 2 Example explosion simulation test of off gas mixture at 170°C / 250°C



▶ CONTINUED ON PAGE 4

PEPCOM  
INTRODUCTION  
**04**  
OF 04

## Expand Your Horizon With PEPCOM Solution

In the past 3 issues of POINT, the components of "PEPC" in POSCO E&C's unique PEPCOM strategy were explained. To recap, an introduction on PEPCOM, an explanation of Planning, Engineering, Procurement and Construction was presented to give you a better understanding of POSCO E&C's wide array of capabilities.

In this year's final edition of POINT, we will take a look at the final component of PEPCOM : OM which is the Operation and Management services provided by POSCO E&C. Although POSCO E&C is an EPC contractor, we provide not only engineering and construction services but also services for the client to properly run and operate the plant.

POSCO E&C's operation and maintenance services cover a wide variety of products and businesses which ranges from iron making plants through rolling mills. Our long standing partnership with POSCO is a testament to our O&M capabilities as POSCO E&C has not only helped POSCO design and build its steel production plants but also assisted POSCO in optimizing its production costs and streamlining its operational efficiency.



Recently, POSCO E&C initiated a collaborative partnership with Daehan Steel, one of South Korea's top steel manufacturers of long products such as deformed bars and shaped bars. This collaboration will focus on expertise and services exchange which will further strengthen POSCO E&C abilities in providing excellent O&M services to customers guaranteeing quality after services and great satisfaction.

Our operation and maintenance services are especially beneficial for new players who are planning to step into the steel industry. Besides engineering and project management, POSCO E&C can provide you with the operation and maintenance skills and tools to help you utilize your plant to its maximum potential which directly leads to increased

productivity and profit turnover.

With this issue's focus on operation and maintenance, this brings a close to the introduction to POSCO E&C's PEPCOM unique services. Through PEPCOM unique strategy, POSCO E&C guarantees its customers excellent engineering, project management and after services. POSCO E&C is the top steel industry contractor in the world which offers end to end services from market research and feasibility studies during the planning stages until streamlining and optimization of plants during the closing phase of the project. So if you are looking for excellent services and guaranteed customer satisfaction, POSCO E&C's PEPCOM strategy will deliver them to you.

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measurement of the transient pressure inside the explosion bomb is also the important factor to quantify the flammability limit and other combustion characteristics.

In conclusion, about 195 successful combustion tests were performed in the spherical explosion bomb to investigate flammability limits and pressure rise rates of the multi-component mixtures. The initial pressure conditions were  $1000 \pm 10$  mbar in all tests. Two initial temperatures,  $170 \pm 2$  °C and  $250 \pm 2$  °C, were selected for the systematic study.

By using a high speed shadow system and optical access via quartz glass windows, the ignition process and the early stage of the flame propagation could be observed. Regarding the influence of dust (coarse, fine),

specifically, we have demonstrated that the gas with dust will show slightly smaller over-pressures than the gas alone. Nevertheless, due to the assumptions applied to theoretical analysis, the values coming from the experiments should only be used for ESP design and no advantages of the possible reduction of the overload by the existence of dust should be utilized. From practical point of view, this is the essential point for the safety analysis.

Lastly, the maximum pressure rise rate of  $(dp/dt)_{max}$  is an important parameter for the design of explosion venting systems, because it essentially determines the time scale within which venting devices must become active. In this study, the maximum pressure rise rate was determined by numerical

differentiation of the measured pressure signal. All experiments resulting in ignition and stable flame propagation in the explosion sphere were analyzed in this way. ☺

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