FARO 3D Laser Scanner Optimizes Erosion Inspection of High-Temperature Materials for Metallurgical and Steel Industries

As one of China's top industries, the steel industry has always been closely watched. With the recent developments in China's economy, the steel industry has experienced significant changes. Due to factors such as supply-side reforms and environmental protection policies, the production environment in steel factories has become more relaxed, but the corresponding production costs have been on the rise. With the homogeneity of finished products in the steel industry, the profitability of the individual smelting companies is highly dependent on the differences between their own processing and manufacturing costs and the minute profit margins common throughout the industry. It is under such competitive conditions that cost reduction and profit maximization of the production processes have become important concerns for companies.

Based in the Zhejiang province of China, Hangzhou Pucheng Teddy Industrial Co., Ltd. (PUTEDY) is an advanced technology enterprise with a strong team of experts and young talents in science and technology. The company specializes in automated monitoring solutions and the research, development, and promotion of the use of automated control equipment in the metallurgical industry. It is committed to providing professional inspection solutions for large ladle slags and converter steel slags to metallurgical companies across the world, helping them achieve safe production and cost control.

Industry

- Plant Engineering

Applications

- High-temperature material monitoring in metallurgical industry

Benefits

- Detect safety hazards in time and prevent major safety accidents
- Save maintenance time and refractory material investment and improve production efficiency
- Collect data of changing trends to aid in optimizing designs and improving technical processes

Challenges in Steel-making Inspections

For many in the industry, the application of Hot Forging Dimensional Inspection, where 3D laser scanning is used for inspections during the steel-making process, is still relatively new. With continued research efforts in this field, PUTEDY has become the first innovative company in China to have established a complete set of dimensional inspection systems. It has assisted many customers in the steel field to improve their rudimentary on-site dimensional inspection processes, including companies like Shandong Iron and Steel Group Co., Ltd., China Baowu Steel Group Corp., Ltd., and Magang (Group) Holding Company Limited.

Common high-temperature steel-making containers.

In the steel-making processes, many containers are used for carrying, transporting, and smelting. These containers are constantly in contact with materials like molten steel, slag, and furnace gases, and are subjected to the effects of long-term physical, mechanical, and chemical erosion. As major safety accidents may occur when the protective layer inside the containers are damaged, regular monitoring and inspection of these containers are imperative.

Containers that need to be cooled off before inspections are carried out.

Shedding light on the the dimensional inspection process, Mr. Shen Guozheng, Head of Research and Development at PUTEDY, commented, “Each steel ladle must be inspected 2 to 3 times per day, with a maximum of 10 to 15 minutes of downtime for inspection.”

This short downtime means that the inspection staff has to work with and inspect an object at a temperature of 1,700°C, with little time for it to cool down.

Harsh working environment within a steel-making factory.

Workers applying manual on-site inspection methods.

“Even when the furnace is 10 meters away, one can only endure the heat of the furnace’s high temperature for up to 30 seconds,” added Mr. Shen.

In addition to the challenges of time and temperature, the inspection site is also often affected by factors such as dust, water leakage, noise, and vibrations, resulting in the harsh conditions and environment at the site.

Prior to the adoption of 3D laser scanners, steel mills depended on manual or rudimentary measurement methods to carry out erosion inspection. For example, after the temperature of the furnace is lowered, the convexity and concavity of the furnace is observed by visually inspecting the changes of the refractory materials, or by extending an iron rod into the interior of the furnace to find a few fixed angles, and the erosion is calculated by comparing the changes.

Regardless of whether the visual inspection, the push-rod method, or other manual measurement methods were employed, the common issue that arose was that these methods relied heavily on the experience of the workers. There was also no way that anyone could verify the accuracy of the data obtained. This greatly affected the production efficiency of the steel mills. In addition, exposure to the high levels of thermal radiation at the inspection site also posed serious health risks to inspection personnel.

FARO 3D Scanners Overcomes the Challenges of Steel-making Inspections

Having had the foresight to begin research in the use of the latest technology for steel-making inspections, PUTEDY now specializes in providing hot forging dimensional inspection for high-temperature material erosion monitoring to its steel mill customers. Mr. Shen commented, “We have always been on the lookout for equipment that would allow us to inspect high-temperature objects. We began exploring the use of 3D laser scanners in 2014 and soon discovered that not all 3D scanners are capable of inspecting objects at high-temperatures of 1,600 – 1,700°C. However, FARO’s scanners were able to offer this function.”

PUTEDY officially purchased its first unit of the FARO Focus^{3D} X 130 scanner in 2016, and subsequently procured four more sets thereafter. Prior to purchasing the FARO scanners, the inspection of high-temperature objects often yielded no data or only a few data points, and this affected the measurement results significantly. The FARO Focus^{3D} X 130, however, is able to complete the measurement task under extremely harsh conditions and yet still obtain the best quality data through on-site compensation to complete this previously-impossible task.

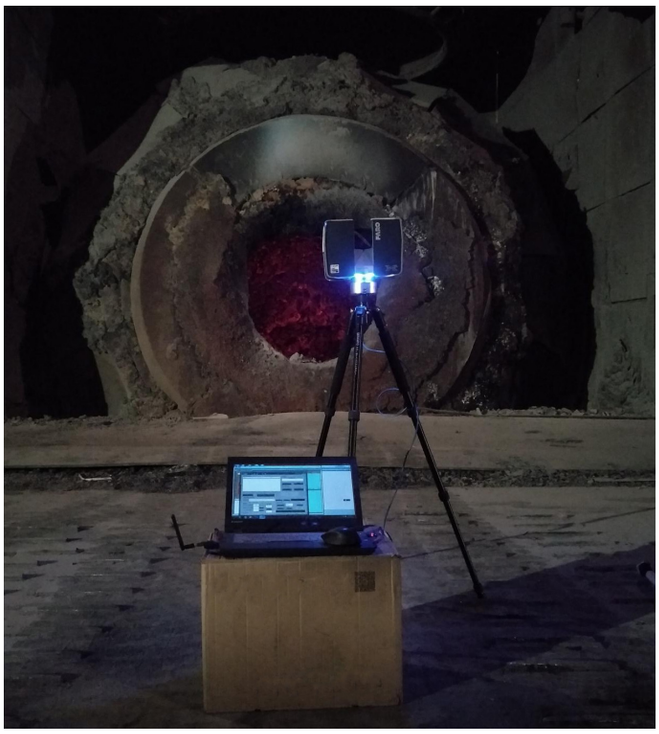
FARO 3D Scanners Improve Inefficient Practices

PUTEDY employs the FARO Focus^{3D} X 130 scanners for hot forging dimensional inspection of steel ladles and iron ladles, regular monitoring of any changes to the refractory materials, and to determine when material filling is necessary. The technology team has incorporated the Focus^{3D} X 130 to develop a long-range 3D scanning system that can carry out non-contact measurement of high-temperature objects. With the simple click of a button, operators can perform scans, data analysis, and calculation, obtaining beautiful displays of scan results and automatic storage management at the same time. This is a tremendous improvement over the original inspection workflow, which was deemed inefficient.

Before the inspection is carried out, the staff will halt production and adjust the angle of the furnace in preparation for the inspection. The 3D scanning system is then moved to the front of the object for inspection, where 2 to 3 sets of data are collected through scans from different angles. Generally, the objects that the team works with on-site are cylindrical in shape, ranging from 3 to 5 meters in diameter, with a wall thickness of 0.6 to 1 meter.

Capable of recording 976,000 points per second, the FARO scanner’s fast scanning speed allows it to complete inspecting the inner surface of a container within minutes. This improves the working efficiency of the inspectors at the site, and more importantly, ensures all the relevant important data is fully recorded. As such, it ensures that all useful information is properly recorded and prevents any omission. In addition, time, manpower, and money can be saved through this improved inspection process.

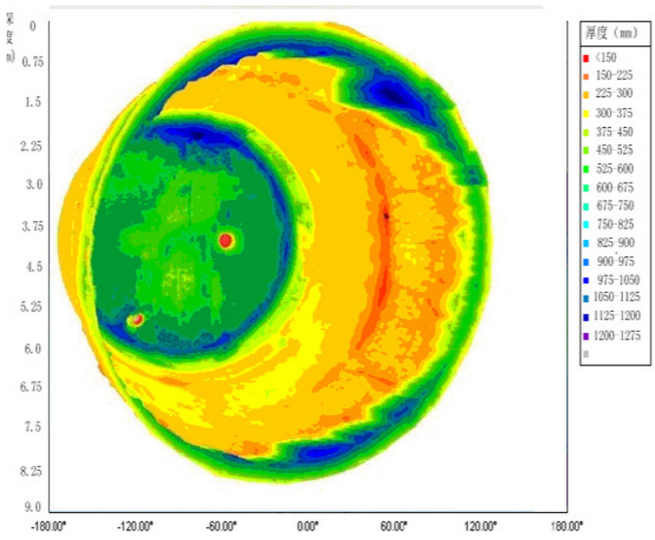
“Our steel mill customers are experiencing very profitable returns for each furnace,” added Mr. Shen. “The ability to carry out the inspection during the exchange of furnaces or during the intervals allows our customers to further maximize their profits.”



Using the FARO 3D laser scanner for on-site inspection.

With the 3D laser scanning technology, the scan data can also be automatically imported into the computer to create a 3D mathematical model of a container’s inner wall. Comparing ‘before-after’ data allows customers to know how much the inner lining may have eroded, including its exact location and detailed data. With the efficient and accurate inspection results, long periods of shutdowns are avoided, and parts of the furnace that need to be filled can also be promptly discovered to avoid overfilling or miss-filling. This saves both maintenance time and investment in refractory materials, while also effectively prolonging the use of furnaces and boosting production efficiency.

Mr. Shen commented, “We decided on the FARO Focus^{3D} X 130 as its scanning speed and accuracy fully meets our demanding on-site measurement requirements. In addition, the scanners offer an extremely high price-to-performance ratio.”



Post-scan data analysis.

Future Applications

The members of PUTEDY’s technology team are predominantly graduates from Zhejiang University, and possess strong academic backgrounds. PUTEDY is committed to tap on its team’s expertise to achieve production intelligence and improve automated workflows for companies in China.

Going forward, PUTEDY will also continue to utilize its strong research and development capabilities to expand its service areas and provide 3D measurement solutions for more applications outside the metallurgical industry, such as coal mines, tunnels, shipbuilding, and protection of cultural relics. The company also hopes to maximize FARO's 3D laser scanning technology for the completion of more inspection tasks.

About Hangzhou Pucheng Teddy Industrial Co., Ltd.

Hangzhou Pucheng Teddy Industrial Co., Ltd (PUTEDY) is an advanced technology enterprise that engages in research, development and production of electromechanical equipment — including signal detection, intelligent instrument, and control equipment — for the metallurgical industry.

Backed by a strong team of experts and young talents in science and technology, PUTEDY has obtained 9 national invention patents and 25 software copyrights. Its products are applied in more than 100 iron and steel enterprises application, and have won a plenty of widespread praise. g technology, are investigated and developed.

For more information, please visit: http://www.putedy.com

About FARO

FARO is the world's most trusted source for 3D measurement, imaging and realization technology. FARO's global headquarters is located in Lake Mary, Florida. The Company's European regional headquarters is located in Stuttgart, Germany and its Asia-Pacific regional headquarters is located in Singapore. FARO has other offices in the United States, Canada, Mexico, Brazil, Germany, the United Kingdom, France, Spain, Italy, Poland, Turkey, the Netherlands, Switzerland, India, China, Malaysia, Thailand, South Korea, Japan, and Australia.

Featured Product

FARO Laser Scanner Focus
FARO's latest ultra-portable Focus^{S} Laser Scanner enable to capture fast, straightforward and accurate measurements of complex objects and buildings. The intuitive touch-screen of the Focus^{S} models has been increased in size and clarity to deliver an extraordinary user experience.

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