



# COPPER

INTELLIGENT SENSOR SOLUTIONS FOR THE COPPER INDUSTRY

Metal and steel

**SICK**  
Sensor Intelligence.

## TASKS IN THE COPPER INDUSTRY

The production of copper is a complex process and includes the extraction and preparation of raw material, froth flotation and thickening, the operation of smelting, refining and refining furnaces, and the casting of anodes via an anode casting wheel as well as electrolytic refining. For each of these process steps, SICK offers a wide range of intelligent sensors and solutions that support the plant operator in mastering the challenges of day-to-day work. The aim is to efficiently use energy and raw material resources, reduce production downtime, ensure consistent product quality and reduce costs.



→ [www.sick.com/Metal\\_and\\_steel](http://www.sick.com/Metal_and_steel)



### Material handling

Material handling is a crucial part of any copper operation and different materials are transported, stored and mixed. With sensors from SICK for level and volume flow measurement, storage and conveying can be controlled efficiently and according to demand.



### Quality control

Product quality must be ensured throughout the production chain. For example, knowing the temperature development within the different process steps is essential for understanding and optimizing the casting process. To check and sort cathodes, they are scanned with cameras and compared with algorithms and metrics.



### Positioning

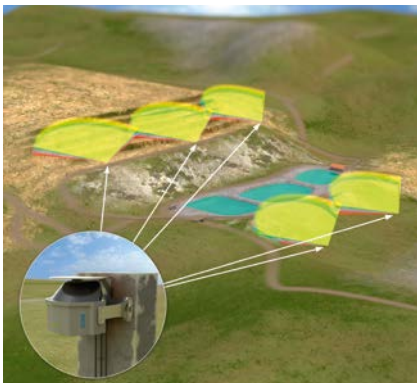
SICK sensors generate information about position, angle, length, etc. of many objects during copper production, e.g. for positioning anode slabs and cathodes. Sensor solutions on cranes, machines, conveyor belts and casting wheel aid and improve the production's efficiency.



### Emission monitoring

The copper industry aims to mitigate the environmental and social impact of copper production, and positively contribute to sustainable development goals. Suitable systems are required to reliably report emission data to authorities and the reporting must occur on the basis of defined standards. SICK can offer the very latest in measurement technology to help meet the demands placed on a modern copper process whether it be environmentally or financially driven.

# RAW MATERIAL EXTRACTION AND PREPARATION



## Monitoring dams in the leaching area

For workers and local inhabitants alike, a precaution against the threat of a dam break includes an early warning when the dam's support structure changes. A 3D LiDAR sensor uses a high scanning point density and an aperture angle of 120° to reliably detect its environment across 24 layers. Mounted on fixed posts across the base of the dam and heap, multiple MRS6000 sensors can detect the slightest of bulges, allowing an alarm to warn humans of imminent danger.

- MRS6000 3D LiDAR sensor



→ [www.sick.com/MRS6000](http://www.sick.com/MRS6000)



## Classifying sieve for sorting raw material

Successful sorting relies on material heterogeneity for optimal crusher operation. A 3D vision solution can make short work of this sorting task. The Ruler3000 delivers millimeter precise data and offers high image quality with superior image processing and reliable measurement results. The high light sensitivity of the Ruler3000 ensures accurate inspection of even very dark materials such as coal. Using the scatter functionality makes it possible to distinguish between different materials.

- Ruler3000 3D machine vision sensor



→ [www.sick.com/Ruler3000](http://www.sick.com/Ruler3000)



## Monitoring efficiency of cyclone separation

Cyclones are used in many processes to treat gases in terms of particle removal. The separated dust can be either by-product or waste. In either case, it is vital to have the best possible separation efficiency, which can be controlled by a set of measurement units. A FLOWSIC ultrasonic flow meter measures the flow rate of the gas through the cyclone, while dust measuring devices DUSTHUNTER deliver dust concentration values before and after the cyclone. Then a calculated mass balance reports what is taking place and allows for countermeasures if needed.

- DUSTHUNTER SP100 scattered light dust measuring device
- FLOWSIC100 gas flow measuring instrument



→ [www.sick.com/FLOWSIC100](http://www.sick.com/FLOWSIC100)



→ [www.sick.com/DUSTHUNTER\\_SP100](http://www.sick.com/DUSTHUNTER_SP100)

## FROTH FLOTATION AND THICKENING



### Measuring froth level and thickness

The process for selectively separating hydrophobic from hydrophilic materials, froth flotation also improves the recovery of valuable minerals, such as copper. Such a substantial action requires precision measurement. An inox level sensor with a rod probe determines the level of the actual liquid sitting under the layer of froth. Using the information from the LFP, a mid-range distance sensor can then measure the true thickness of the froth.

- LFP Inox level sensor
- Dx35 mid range distance sensor



→ [www.sick.com/LFP\\_Inox](http://www.sick.com/LFP_Inox)



→ [www.sick.com/Dx35](http://www.sick.com/Dx35)



### Monitoring froth bubble quality

Air in the form of bubbles is one of the critical inputs in the froth flotation process. The correct air input produces froth with proper bubble size distribution, which leads to increased copper mass recovery. Knowing the size of the froth bubbles can therefore determine the optimal completion during the flotation process. A 3D camera can reliably and accurately measure the surface bubble size of the froth.

- Ranger3 3D machine vision sensor
- Ruler3000 3D machine vision sensor

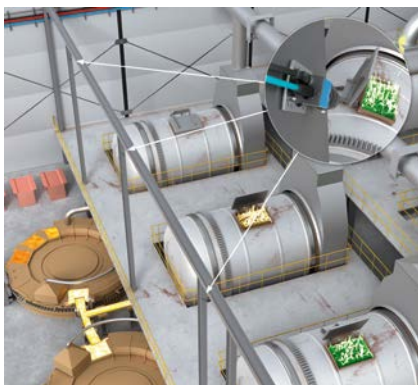
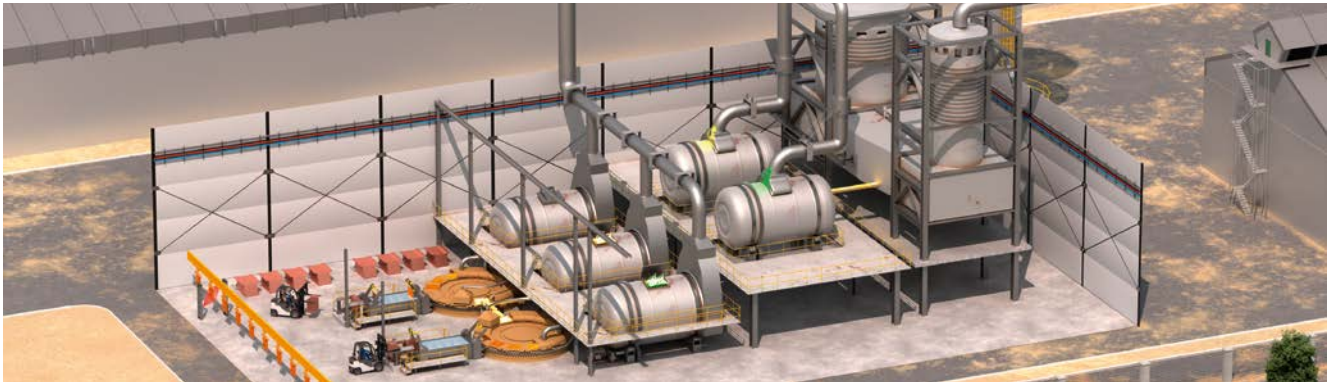


→ [www.sick.com/Ranger3](http://www.sick.com/Ranger3)



→ [www.sick.com/Ruler3000](http://www.sick.com/Ruler3000)

# SMELTING, CONVERTING AND REFINING FURNACES



## Detecting of flame color in anode furnaces

Purifying copper in anode refining furnaces eliminates or reduces many impurities. Fire refining consists of oxidizing impurities and removing them, followed by the reduction of copper oxide to obtain copper anodes. When the flame burns from orange to green, pure copper has been achieved. A compact picoCam2 industrial 2D camera, mounted at a sufficient distance, can be connected to a Sensor Integration Machine to monitor flame color changes.

- picoCam 2D machine vision sensor
- SIM1012, SIM2500 Sensor Integration Machine



→ [www.sick.com/picoCam](http://www.sick.com/picoCam)



## Monitoring level of molten slag and copper

Monitoring the level of molten slag and copper in the flash furnace settler does not require x-ray vision, just a long-distance measuring device. The DT1000 housing from SICK is made of corrosion-resistant aluminum alloy, which is dust- and water-resistant, making it sturdy enough to withstand the furnace's intense heat. The HDDM+ technology is characterized by low noise in the measured value data as well as multi-echo capability to tackle the harsh visibility conditions in the furnace.

- Dx1000 long range distance sensor



→ [www.sick.com/Dx1000](http://www.sick.com/Dx1000)



## Identifying position of the anode refining furnace drum

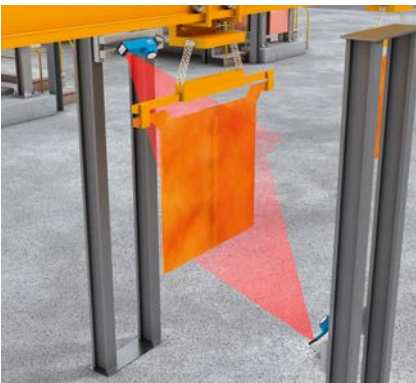
Knowing the exact position of a drum guarantees excellent plant efficiency of an anode refining furnace. An absolute encoder can help increase process efficiency, which in turn leads to shorter tap-to-tap times, better quality, lower oxygen levels in the product and reduced fuel consumption at lower emission levels. Positioned on the drum's motor or the gear box, the stainless-steel encoder is highly resistant to environmental influences and is also easy to mount and program.

- AFS/AFM60 Inox absolute encoder



→ [www.sick.com/AFS\\_AFM60\\_Inox](http://www.sick.com/AFS_AFM60_Inox)

# ANODE CASTING WHEEL



## Inspecting anode shape

Molten copper is distributed into molds in a moving casting wheel to form anodes. Once solidified, the anodes are removed from the casting wheel and inspected. A 3D camera inspects each anode to ensure it complies with the defined shape and form. A Ruler3000 delivers accurate measurement results down to micrometer level.

- Ruler3000 3D machine vision sensor



→ [www.sick.com/Ruler3000](http://www.sick.com/Ruler3000)



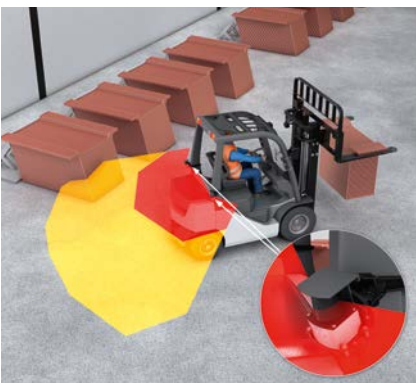
## Detecting anode void

The form should be monitored to ensure that the anode mold on the casting wheel is empty and free of any previous anodes. This task can be performed effortlessly by a rugged long range distance sensor. A distance sensor measures accurately even when mounted more than 10m away. Its rugged metal housing protects the device from the harsh conditions and constant heat generated by the casting environment.

- Dx500 long range distance sensor



→ [www.sick.com/Dx500](http://www.sick.com/Dx500)



## 2D rear area monitoring with active warning for manned forklift trucks

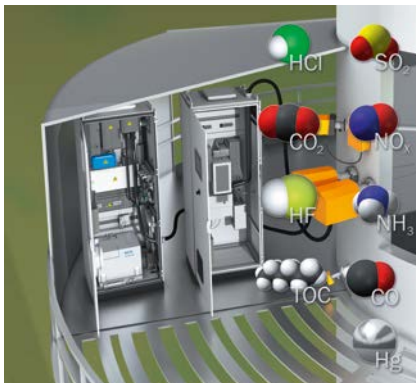
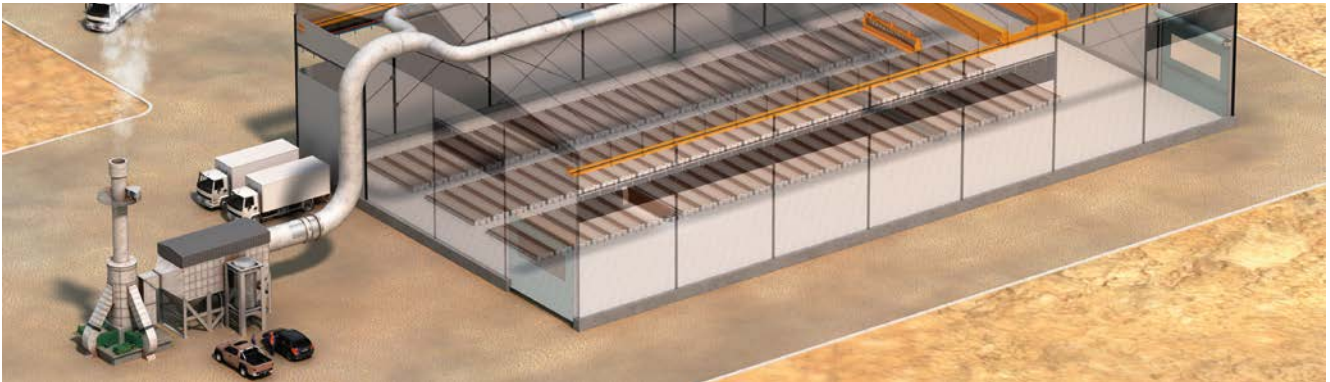
Areas behind the vehicle that are difficult or impossible to see from the driver's position are systematically monitored. The driver is warned with acoustic and visual alarms if the manned forklift truck comes dangerously close to moving or stationary objects. The areas to be monitored can be precisely defined with the use of freely parameterizable 2D LiDAR sensors. The Backup Assistance driver assistance system can be flexibly adapted to a wide range of vehicle models and can also be individually adjusted to the desired driving situations as needed.

- Backup Assistance System driver assistance system



→ [www.sick.com/Backup\\_Assistance\\_System](http://www.sick.com/Backup_Assistance_System)

## ELECTROLYTIC REFINING



### Analyzing gas composition of tank house exhaust

The electrolytic process is undertaken using a slab of impure copper as the anode and a thin sheet of pure copper or stainless steel as the cathode. The electrolyte is an acidic solution of copper sulphate. By passing electricity through the cell, copper is dissolved from the anode and deposited on the cathode. This process creates an acid containing off-gas that must be monitored before being released into the atmosphere. A dust measurement device, a gas flow meter and flue gas monitor should be used for this task.

- DUSTHUNTER SP100 , FLOWSIC100, MCS200HW



### Positioning of cranes

During the electrolytic refining process, cranes are used to transport the anodes and cathodes throughout the hall. Proper positioning of the crane is critical. A heavy-duty linear encoder such as the KH53 is ideal for accurate crane positioning in such harsh environments. In addition, it is completely maintenance-free, which saves time and money for the plant.

- KH53 linear encoder



→ [www.sick.com/KH53](http://www.sick.com/KH53)



### Measuring level in open refining tanks

Tanks are filled with acid and the anodes and cathode are submerged during the electrolytic refining process. The acid level should be monitored to ensure sufficient coverage. This acidic monitoring task can be performed by rugged, non-contact, pressure-resistant sensors, such as a UP56 Pure which saves the plant owner time and increases availability.

- UP56 level sensor



→ [www.sick.com/UP56](http://www.sick.com/UP56)

## SICK AT A GLANCE

SICK is a leading manufacturer of intelligent sensors and sensor solutions for industrial applications. With more than 10,400 employees and over 50 subsidiaries and equity investments as well as numerous agencies worldwide, SICK is always close to its customers. A unique range of products and services creates the perfect basis for controlling processes securely and efficiently, protecting individuals from accidents, and preventing damage to the environment.

SICK has extensive experience in various industries and understands their processes and requirements. With intelligent sensors, SICK delivers exactly what the customers need. In application centers in Europe, Asia, and North America, system solutions are tested and optimized in accordance with customer specifications. All this makes SICK a reliable supplier and development partner.

Comprehensive services round out the offering: SICK LifeTime Services provide support throughout the machine life cycle and ensure safety and productivity.

**That is “Sensor Intelligence.”**

### **Worldwide presence:**

Australia, Austria, Belgium, Brazil, Canada, Chile, China, Czech Republic, Denmark, Finland, France, Germany, Great Britain, Hungary, Hong Kong, India, Israel, Italy, Japan, Malaysia, Mexico, Netherlands, New Zealand, Norway, Poland, Romania, Russia, Singapore, Slovakia, Slovenia, South Africa, South Korea, Spain, Sweden, Switzerland, Taiwan, Thailand, Turkey, United Arab Emirates, USA, Vietnam.

Detailed addresses and further locations → [www.sick.com](https://www.sick.com)