

Bluewrist Case Study

Copper Anode Plate 3D Vision Inspection

Our Client

Our client, one of the largest copper refineries in China, produces approximately 7,000 copper plates each day – with an annual output of 600,000 tons of copper. Central to the process of high-quality copper production is the quality of copper anode plates. The copper anode plates should be free of physical defects such as cracks, unevenness or debris before inserted into the electrorefining pool. Each copper anode plate measures 1m x 1m x 0.05m in size and weighs 380 kg each.

The Challenge

The client had three inspection points required within the copper refining process:

- The copper anode plates produced from the copper smelter
- The refined copper sheet, which becomes the end product
- The stainless-steel frame, which holds the copper sheet

The business used a manual quality assurance process at each stage. This approach was prone to human error, an issue that was compounded by the size and color of each plate and the limited time available to carry out inspections. The client needed a solution to automate the process and provide accurate and reliable results. As the client's process for producing high-quality copper requires up to three weeks, the plates used must be of the highest quality, free of debris and defects and perfectly smooth. Any deviation from these standards can lead to an accumulation of unwanted copper deposits, which subsequently reduce the



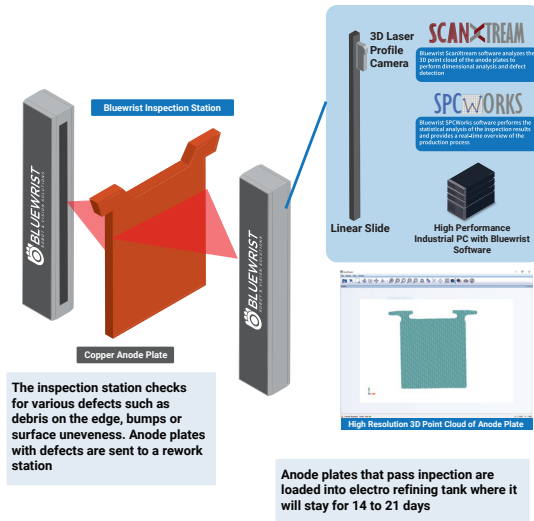
quality of the finished product, potentially leading to much lower market value – a real commercial risk for the business.

The Solution

We designed five fully-integrated inspection scan boxes, each housing a 3D laser profile scanner mounted on a linear slide. Each unit has a high-performance workstation, quickly scans the large surface area of each anode plate, cathode plate, and refined copper sheet with **0.5mm accuracy**. For the copper anodes, the process works alongside the manufacturing process, so as each copper anode plate is removed from the quenching pool by a Kuka industrial robot, it is placed on a conveyor system and transported to the first inspection station. At this point, the plate edges are checked for debris, and the surface quality is assessed for bumps and unevenness. If defects are detected, the anode plates are sent to a rework station for additional processing. The defects location is labeled in the Bluewrist software to guide the robot to grind the defects. Once complete, the anode plate and stainless-steel cathode plate are

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alternately set into the electrorefining tank where direct current (DC) is supplied. As a consequence of the electrical current, the copper from the anode is ionized, allowing it to be deposited electrolytically on the stainless-steel cathode plate. After 14 to 21 days, the new copper plates are removed from the tank and placed on a second conveyor for further inspection. This scan box checks the overall surface quality of the pure copper sheet, with each sheet given a quality grading. Finally, the copper sheet is peeled from the stainless-steel cathode plate, which then undergoes a final inspection to check for warping or damages. The results of this scan determine whether the cathode plate will be reused or recycled.

Bluewrist industrial communications and 3D vision processing software played a pivotal role in ensuring the success of this project. Bluewrist comXtream industrial communications software acted as the central hub for PLC, robot and 3D sensor communications. One example of comXtream involvement is after the anode plate is scanned for debris on the edges, comXtream software streams the 3D point cloud data to the ScanXtream 3D point cloud processing software for defect analysis.

The result is passed back to comXtream, which then triggers the next PLC action for reject or pass, or sends the specific commands and coordinates to the rework station where robots with grinder wheels will remove the excess debris. SPCWorks records dimensions and provides statistical process control. Due to the size of the anode plates, high-density point clouds are generated, and the ScanXtream software effectively processes them in under 10 seconds.

The Results

Our inline 3D inspection solution ensures that 100% of the copper anode plates are fully inspected prior to the refining process. This solution significantly reduces scrap costs as undetected debris on the copper anode plate leads to inferior quality final copper deposit that can only be discovered at the end of the three weeks process. In addition, the final inspection of the refined copper sheets can be accomplished much quicker and more accurately compared to manual inspection. This solution has led to a significant improvement in the overall quality of the final product and material output at the client's plant.

Contact Bluewrist Today!

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