RFID optimizes production and delivery processes for cast aluminum

Aleris Recycling

Manufacturing cast aluminum alloys requires precise mastery of the production and logistic processes to meet the required quality while keeping energy consumption as low as possible. For the first time, radio frequency identification (RFID) can now also be used on hot transport crucibles for molten aluminum.

Aleris Recycling is a leading aluminum recycling company with four sites throughout Europe and an annual processing capacity of over 400,000 tons of scrap aluminum. The plants process the delivered materials into products such as cast aluminum alloys in line with the customers' detailed specifications. Some of the materials are delivered in molten form: After melting and mixing all of the components, the aluminum is poured into special, insulated thermal transport crucibles which delay the solidifying of the aluminum by several hours. Despite the impressive insulation, temperatures of up to 130 °C still occur on the external surfaces of the containers. The filled crucibles are then transported to the customer by specially designed trucks.

Tough demands on process accuracy

The demands placed on the accuracy of manufacturing and logistics processes are enormous. Depending on customer specifications, in some cases alloys may only differ fractionally from the defined properties. Contaminations, such as resi-dual metal stuck on internal surfaces of the crucible from previous usages, must therefore be prevented. The consequence: The crucibles are cleaned at specified intervals and also based on specific usage, which is costly in terms of time and energy.

The minimum required temperature of the aluminum on delivery must also be specified accurately.

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The aluminum is transported in molten state in specially insulated crucibles

The large range of the UHF system allows cost-effective antenna installation outside the danger area.

However, since the insulation lining (firebrick lining) is subject to certain wear, different heating-up times with high energy requirements must be maintained based on the usage of the crucible to date. The calculated travel time to the customer also plays a role, as despite the insulation the aluminum cools by a few temperature degrees per hour. Errors are costly here. If the aluminum is delivered too cold, the material has to be subsequently heated up by the customer or, in certain circumstances, can no longer even be used at all. However, overheating the aluminum results in unnecessary energy costs.

Having the greatest possible degree of transparency regarding crucible usage and guaranteeing accurate delivery times are therefore key factors for Aleris when it comes to meeting customer demands with minimized resources. Radio frequency identification (RFID) is the resource of choice here. Small radio chips (transponders) are attached to the crucibles and automatically scanned at the various processing points, sites and goods in/out locations. Additional information (e.g. on the filling temperature) is added to the data gathered here, forming a comprehensive "Crucible profile" which can provide information on the location, content and state of any crucible at any time. If this information is recorded in a database, it allows a comprehensive crucible history to be created which can then in turn be used for optimizing container usage to reduce energy consumption. A decentralized solution is also conceivable, directly providing relevant information on the RFID transponder of the crucible.

Until now, high surface temperatures on the crucibles have prevented cost-effective usage of RFID transponders. While heat resistant RFID transponders with a large working range do exist on the market, they cannot be used cost-effectively due to the high costs involved.

RFIDs usage possible on hot crucibles

The center of competence for weighing system engineering of the FIWA Group's engineering office, based in Burghausen, has now developed a solution that allows cost-effective UHF-RFID technology to be used on hot crucibles in accordance with the EPC global standard. The SIMATIC RF620T transponder from Siemens can be utilized thanks to a cleverly thoughtout design, consisting of several insulating layers with ambient air circulating between them. The transponder is already designed for a temperature of 80 °C and is also sufficiently protected against dust and liquid (e. g. rain water during transportation) by its robust plastic enclosure with IP67 protection. "Our special development and assembly on the crucible ensures that the relatively high heat emission of the crucible is reliably dissipated by the transponder", explains Peter Geiwagner, head of the FIWA Group's center of competence. The RFID solution is embedded into a patented, continuous crucible filling and emptying system on a weighing basis.

Through UHF technology (865 MHz), the transponder is able to provide a reading range of a few meters. The advantage: the antennas for exchanging data with the transponders can be attached to the HGV scale at the goods out section or at the various sites (heating, cleaning and filling station) outside the danger area. The metal environment of antennas and transponders does not pose a problem here: "The acquisition rate even remains constant with steel ramming guard devices", comments Mr. Geiwagner.

The SIMATIC RF600 system is used due to the robustness required. RF660A antennas can be used in external areas of industrial systems without additional protective measures. Four antennas have been installed on the reader station at the entrance to the Töging plant to achieve a maximum acquisition rate. The radio signals are evaluated by a SIMATIC RF660R reader. They are transferred via an Ethernet cable to a PC on which the SIMATIC RF Manager software filters, logs and transmits the relevant data to higher-level software layers.

Significant advantages for manufacturers and customers

The combined solution with FIWA Group and Siemens components has already proved itself in an Aleris pilot project over several weeks. RFID offers significant advantages for the sector. Through increased transparency, crucibles can be used more effectively thanks to the attached RFID transponder. The seamless overview of where the crucibles are located also leads to improved organization at the plant. Crucible data (temperature, filling weight, departure time) also serves as an automatically generated record for product and delivery quality at goods out.

In the end product, Aleris customers also benefit from the RFID solution if certain data such as the filling weight and expected temperature can be send to the purchaser prior to arrival. Moreover, the application of EPC global standards (Gen 2) ensures that the required RFID infrastructure can also be used for other applications in goods logistics. With a minimum of effort, quality is increased while costs are lowered – benefiting all involved parties.

The high external temperatures are dissipated to the ambient air through a multilayered design so that the SIMATIC RF620T transponder (below the white cover plate) is operated within the specification.

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