Fiber Optics and Lasers make the Steel Industry More Competitive

RISE Acreo develops sensor technologies together with Swedish steel industry. The solutions are based on fiber optics and enable real-time measurement of temperature and atomic composition in manufacturing and recycling processes. Decreased energy consumption, improved quality, enhanced proactivity and better recycling opportunities are some of the results.

Proper process temperature is of great importance in the steel industry. Despite that, relatively few measurements are carried out during processing due to the extreme conditions. For instance, it was previously impossible to measure temperatures inside the blast furnaces, where the heat can reach as high as 2 500 degrees Celsius.

Measurements at several steelworks
In a series of projects, RISE Acreo has implemented fiber optic solutions for continuous temperature measurement at several large steelworks in Sweden. At SSAB Luleå Tunnplåt, measurements have been carried out during production, both in conversion processes and in molds. At Sandvik, measurements have been performed in converters used for production of stainless steel. Temperature measurements have also been conducted at SSAB Oxelösund and in the experimental blast furnace at LKAB.

Work more proactively
In another ongoing project, RISE Acreo measures the temperature in the ladles that transport the fuse metal. Over time, the refractory lining material inside the ladles wears out. By monitoring the temperature of the lining it is possible to work more proactively and avoid accidents by replacing the refractory material in time.

“The fiber optics will be placed within the ladle’s wall. A hole the size of one millimeter in the outer wall is enough to get thousands of measurement points,” says Erik Zetterlund at RISE Acreo.
Laser enables efficient recycling processes
In traditional recycling processes, the composition of scrap metal is determined off-line by melting down the scrap metal mixture. LIBS (Laser Induced Breakdown Spectroscopy) enables on-line material identification of the solid waste products as they are transported on the conveyor belt. Better knowledge of the scrap composition can improve the effectiveness of the recycling processes and give great savings of time and energy.

The LIBS method is a non-contact analysis technique in which a laser pulse is directed onto the piece of scrap-metal being examined. The intense laser pulse creates a plasma, a spark with a unique color composition, on the metal surface. Light from the plasma is collected and analyzed with a spectrometer and the atomic composition of the metal can be revealed.

On-line analysis
Field tests with a LIBS prototype, developed by RISE Acreo and Swerea Kimab, have been successfully conducted at several of Stena Recycling’s scrapyards, demonstrating on-line monitoring of the metal scrap composition. The next step is to integrate a sorting mechanism connected to 10–12 containers. The LIBS system has also been tested at one of Outokumpu’s steelworks.

With the use of fiber optics and laser, RISE Acreo has developed methods that increase the process control in steel production and that can automate recycling.