Manfred Bock, project manager consulting electric, BSE, accepted a plaque of appreciation (left to right): Patrick Hansert, Ron O'Malley, Bock, Harriet Dutka and Stephan Ferenczy.

Ron O'Malley (right), AIST first vice president, Missouri University of Science and Technology, and Pat Philbin (left), AIST manager – technology programs, have participated is six AIST Study Tours to date.

Receiving a plaque of appreciation is Andreas Volkert, plant manager at BSW (left to right): Stephan Ferenczy, Patrick Hansert, Harriet Dutka, Volkert and Ron O'Malley.

AIST ESTC Electric Steelmaking Study Tour — Germany

by Dustin Arvola and Kyle Tew

3-7 December 2018

In December 2018, the AIST Electric Steelmaking Technology Committee (ESTC) kicked off its fourth EAF Study Tour in Germany. A country known for its technological advancements in steelmaking, Germany was ranked seventh in the world for crude steel production in 2017 at 43.4 million metric tons, and continued to grow in capacity throughout 2018. German steel is a popular choice in the automotive and defense sectors.

The study tour's 26 participants represented steel producers and suppliers from several countries: Steel Dynamics Inc., Nucor Corp., Commercial Metals Company, SANGRAF International, Air Products & Chemicals, Showa Denko Carbon, The Systems Group, SMS group Inc. and Missouri University of Science and Technology in the U.S.; Frisa Steel and AMI GE International in Mexico; Lhoist in Belgium; Badische Stahl Engineering (BSE) GmbH in Germany; and Vallourec Soluções Tubulares do Brasil in Brazil. The goal of the study tour was to provide the opportunity for participants to network and exchange technical information while touring three steel plants in western Germany that utilize electric arc furnace (EAF) technology. Participants gathered in Strasbourg, France, for introductions and dinner on Sunday, 2 December.

Monday, 3 December 2018

The first plant visit was to Badische Stahlwerke GmbH (BSW) in Kehl, Germany. The tour group was welcomed by Patrick Hansert, executive vice president of BSE America, and the BSW engineering staff. Several presentations were given that covered both the company's history and operations, followed by a tour of the plant. The Badische Group started as a wire processing plant in 1955, and has since developed into a market leader for producing reinforcing steel in Germany. The BSW site produced nearly 2.5 million metric tons in 2017 with a workforce of 2,200 employees. This level of production is quite impressive considering the strict environmental regulations (air, water, noise, etc.) that are imposed on the facility as a result of its close proximity to residential areas.

Scrap is brought to the facility by barge on the Rhine River, and is then off-loaded by four scrap cranes. The primary scrap commodities used are shred, HMS #1 and #2, busheling, and turnings. There are four transfer cars that transport the charging buckets from the scrap yard to the meltshop. These charge buckets feed two 110-metric-ton AC EAFs that produce steel at a rate of approximately 360 metric tons per hour, and tap weights of 117 metric tons per heat. There are two ladle furnaces and a total of 16 ladles in the fleet. Implementing a "cradle to grave" philosophy, BSW produces its own ladle bricks by reusing crushed bricks from ladle tear-outs. The plant has two casters with spray-cooled molds that produce billets. One is 6-stranded with a 33-metric-ton tundish, and the other is 5-stranded with a 28-metric-ton tundish. Nearly 88% of all billets are hot-charged into one of the two rolling mills on-site.

BSW has maintained a high level of efficiency by investing in its most important resource: the employees. Its philosophy is that success is defined by 20% technique and 80% employee. Optimal efficiency of the plant can only be achieved as a team, and that requires motivation, education and flexibility to establish continuity. As a result, BSW scouts for future employees as young as elementary students, offers apprenticeships to high school students, and provides extensive hands-on training to existing employees.

Tuesday, 4 December 2018

On the second day, the group returned to BSE for a brief mini-seminar that covered the technical aspects of steelmaking at BSW. Manfred Bock, BSE project manager, presented on the topic of AC EAFs and how they work electrically. At the conclusion of the presentations, the delegates departed to Sindelfingen to tour the Daimler AG Mercedes-Benz plant. Founded in 1915, this facility now has more than 25,000 employees and produces over 310,000 upper-range and luxury-class vehicles annually. It spans a little over one square mile, and houses Daimler AG's development, design and research facilities. Anita Juric, Daimler AG host, served as tour guide throughout the facility. From the stamping presses that form the body of the car to the final assembly line where workers manually assemble the car's interior, it is evident that this plant has created a near-perfect partnership between man and machine. Watching steel coils arriving by truck to be fed into the Mercedes-Benz stamping presses was quite a sight to behold. There was a deep appreciation among the flat roll employees in the tour group.

Wednesday, 5 December 2018

On the third day, the group departed for Siegen to tour BGH Edelstahl Siegen GmbH. The company was founded in 1467, and currently has more than 2,000 employees. This plant focuses on the production of specialty steel forgings, and produced 136, 742 tons in 2017. What makes this plant unique is its combination of steel mill and foundry practices. The steel is melted in a 55-metric-ton EAF, and produced at a rate of 25 metric tons per hour. For high-alloy steels, the liquid metal is transferred by ladle to a 50-metric-ton argon oxygen decarburization converter. For carbon-based steels, the ladle is transported to a ladle furnace, followed by vacuum tank degassing. Instead of continuous casting, BGH employs an ingot casting method where the ladle is poured into a fixed mold. These ingots are first sent to a reheating furnace, and then to either a 40-MN forging press or a 20-MN radial forging machine. After forging, the castings are heat treated and then quenched. Available quenching media include air, water or polymer. These castings are then machined into the final bar product. Finishing machines available at BGH include two peeling lines, 19 turning lathes, three deep boring machines, six CNC boring and milling machines, one interior grinding machine, and one honing machine.

Thursday, 6 December 2018

On the fourth day, the group remained in Siegen to tour Deutsche Edelstahlwerke (DEW). This company formed in 2007 through a variety of mergers with original locations dating back to 1846. Today, the company has built its reputation as a leading producer of stainless steel long products in Germany. It is comprised of five plants that employ nearly 4,000 workers and produces approximately 1 million metric tons of stainless steel every year. The Siegen site is a part of the Deutsche Edelstahlwerke Specialty Steel division, which produces billets, blooms and rounds. The rounds range in diameters from 310 mm to 500 mm. The meltshop has a wide range of capabilities that includes two 130-metric-ton EAFs, two ladle furnaces, a double vacuum oxygen decarburizer and an RH vacuum degasser. The steel is either ingot casted in molds up to 40 metric tons in size or sent to a 2-stranded continuous caster. Both cast products can be sent to the rolling mill, followed by heat treatment, pickling, wire drawing and/or finishing processes. Or these products can be sent for electroslag remelting or vacuum arc remelting to produce a clean, high-quality ingot. After the tour, the tour group departed to its final destination in Düsseldorf.

Friday, 7 December 2018

On the last day of the tour, the group visited the technical offices of the SMS group GmbH in Düsseldorf. This company is largely responsible for the design of new steel mills and improvements of existing ones. Wolfgang Linden, head of electrics/automation steelmaking and environmental technology, welcomed the delegates and gave them a tour of the facility. The offices utilize virtual reality to simulate the everyday operations of a steel mill. They also provide customer support to steel mills around the world using virtual reality. Rooms are set up to look like either a furnace, caster or rolling mill pulpit so that SMS group employees feel like they are in the steel mill. It is by this method that many new technologies are developed. The SMS group gave a series of presentations detailing a variety of such innovations. These included a slag door pusher known as the CONDOOR®, a more efficient EAF burner known as the SIS Plus, an improved canopy roof, and two furnace designs known as the SMS Shaft Arc Furnace and ARCCESS® Primary Energy Melter.

Many of the attendees traveled far to participate in the Germany Study Tour, but it was well worth the journey considering the experiences gained, connections made and information learned. Although the backgrounds of members in the group may have varied, each one of them is bringing back valuable concepts and ideas learned during this study tour that will greatly benefit their companies and their own personal growth. It is encouraging to see the progress in steelmaking processes that has been made throughout German history, and the potential that exists worldwide for the steel industry moving forward.

On behalf of AIST and ESTC, the 2018 EAF Germany Study Tour group would like to extend its gratitude to all of the companies for allowing us to tour their facilities and to the hosts that made the experience educational. A special thanks go to the companies that chose to sponsor dinners during the trip: Badische Stahl Engineering GmbH, SANGRAF International, SMS group Inc., AMI GE International, Air Products, Showa Denko, Lhoist and The Systems Group. The group would like to acknowledge Patrick Hansert for providing guidance and facilitating the trip; BSE for providing the safety equipment during the tours; and Pat Philbin and Jessica Yurko from AIST for making the arrangements for the trip.

Anita Juric (center), Daimler AG host, accepted a plaque following an excellent tour of the plant assembly operations. Ten different Mercedes-Benz models are produced at this facility.