

## Continuus-Propenzi Develops Closed-Mold Technology for Green Aluminum Ingots

Aluminum is considered to be one of the most sustainable circular materials, due to it being infinitely and 100% recyclable. However, it's important not to waste even one gram of the material, since the production of primary aluminum is so highly energy intensive. In the electrolysis process, direct CO<sub>2</sub> emissions occur due to the reaction between the oxygen and carbon, resulting in anode effects that create PFC emissions. Direct emissions vary greatly depending on the kind of electrolysis cell used, but generally speaking, producing just 1 ton of aluminum requires up to 17,000 kWh of electricity and generates 3.5 tons of direct CO<sub>2</sub> emissions into the atmosphere. The total global average emissions vary somewhat in the literature, but the most reported values are between 12 and 17 tonnes of CO<sub>2</sub>e per metric ton of aluminum.

Greener aluminum starts at the beginning of the production chain—where primary aluminum is produced and is solidified into ingots for remelting or processing into different types of semi-finished products. Realizing this, most primary producers are already reducing their consumption of electricity and working to source it through renewable energy in order to reduce CO<sub>2</sub> emissions during liquid aluminum production.

Continuus-Propenzi in Italy is committed to supporting the primary aluminum industry in reducing its environmental impact. For this purpose, the company has designed a continuous casting process with closed-top molds that does not waste liquid aluminum and features an internal energy bank that results in a significant reduction of CO<sub>2</sub> emissions. This continuous casting method results in the production of what Propenzi calls, CO<sub>2</sub>ntinuous Green Ingots, signifying the reduction in emissions compared to traditional ingots solidified in open-top molds (Figure 1).

### Green Ingots

Development of CO<sub>2</sub>ntinuous Green Ingots began almost 30 years ago, when Continuus-Propenzi worked to overcome the limits of producing ingot in traditional open-top molds. At the time, Giulio Propenzi, currently the company's president and CEO,



Figure 1. A Properzi track and belt caster in operation. Using closed-top molds, the caster is able to reduce the carbon footprint of the process.

had the idea to apply the Propenzi continuous casting method (patented by his father Ilario Propenzi in the 1940s) to the production of aluminum ingots. This resulted in the development of a continuous casting process with closed-molds capable of producing CO<sub>2</sub>ntinuous Green Ingots.

Traditional casting machines utilize open-top molds. Because the molten metal is exposed to the open air, dross is generated on the surface of the metal, which has to be manually skimmed by the operators. Hundreds of tons of aluminum is being converted into dross and removed every year, representing a significant loss of metal. In addition, the management and further processing of the dross is an additional source of CO<sub>2</sub>e generation.

Furthermore, the dross formed upon the liquid aluminum surface cannot be completely removed from the ingots, resulting in lower quality. The oxides (mainly Al<sub>2</sub>O<sub>3</sub> and MgO) caused by dross can also become stuck on external components, such as fragments of refractory material from the casting channels, during the casting process. Since the oxides have much higher melting points, they can cause operational problems, including higher consumption rates and increased amounts of slag, which thereby generate additional CO<sub>2</sub>e.

Within the Propenzi casting machine, the liquid aluminum solidifies inside of the copper mold, which is enclosed by a steel belt, eliminating any contact with air. As a result,

the casting process is able to reduce dross generation down to zero.

Another benefit of the Propenzi continuous casting line is the use of a rotary shear. Traditional casting processes cut ingots to size through saw cutting, which generates aluminum waste in the form of chips. The act of sawing, with its need to manage wet lubricants and the amount of wasted aluminum (and its related CO<sub>2</sub>e), creates a significant environmental impact. In the Propenzi process, the continuous cast bar is cut with a rotary shear that does not generate any aluminum chips, resulting in zero metal loss.

Finally, the Propenzi ingot bundles are also more compact and stable than bundles of ingots from traditional open-top molds. This reduces the PET and/or steel strapping material required to deliver a ton of ingots by about 40%, which represents an additional CO<sub>2</sub>e savings.

After a thorough study of CO<sub>2</sub>ntinuous Green Ingots, Continuus-Propenzi calculated that the process results in up to 280 kg of CO<sub>2</sub>e being reduced for every ton of primary aluminum converted into ingots (compared to other casting processes on the market). In addition, the process provides high quality and increases metallic yield and packing density. The company has published these results in a detailed technical report that has been independently verified by BSI Group. Continuus-Propenzi will make this report available to interested parties upon request. ■