INTERNATIONAL
ALUMINIUM
JOURNAL

© Hertwich

SPECIAL: Energy, Resources, Environment & Sustainability in the aluminium industry

Energy considerations – an industry route map

Aluminium cycle: machining, briquetting, melting

Otto Fuchs orders melting furnace from Hertwich

New sustainability reports from EGA and Constellium

New life cycle assessment of aluminium beverage cans

Innovative, water-heated log preheating saves energy and costs

Reports in the run-up to Euroguss 2020

Volume 95 · December 2019
International Journal for Industry, Research and Application
12

Energy consumption for recycling aluminium in melting furnaces

The production of primary aluminum brings about a severe environmental burden due to the extremely high energy requirements for this process. Secondary aluminum production however contributes to reducing energy demands and greenhouse gas emissions by around 90-95% in remelting scrap. It has been reported, using benchmark data, that the carbon footprint for 100,000 tons of primary aluminum production is 383 kt CO_2; using scrap recycling technologies it is reduced to 29 kt CO_2.

The remelt facilities provided by Melting Technology (a division of the Presezzi Extrusion Group) for recycling scrapped aluminium are designed to achieve the best production performances by minimizing specific energy consumption (expressed in Nm^3/t of CH_4 or kWh/t) while respecting European emission limit values. Energy savings come from thermal recovery of the hydrocarbons from paint, plastic and grease in a „dirty" scrap charge. During the preheating phase for the scrap, up to 75% of the consumption of gas is replaced by the intrinsic energy generated by the gasified hydrocarbons contained in the system.

The specific fuel gas consumption in all our furnaces varies from 400 to 600 kWh/t of aluminum produced (depending on the type of scrap and the de-laquering – de-coating technology used) during a continuous operating cycle subject to the amount of organic impurities.

The CO_2 emissions of the process are directly linked to the thermal heating or melting efficiency when burning fuels containing carbon.

During recent years our efforts and our studies have focused on melting furnaces and de-coating plants.

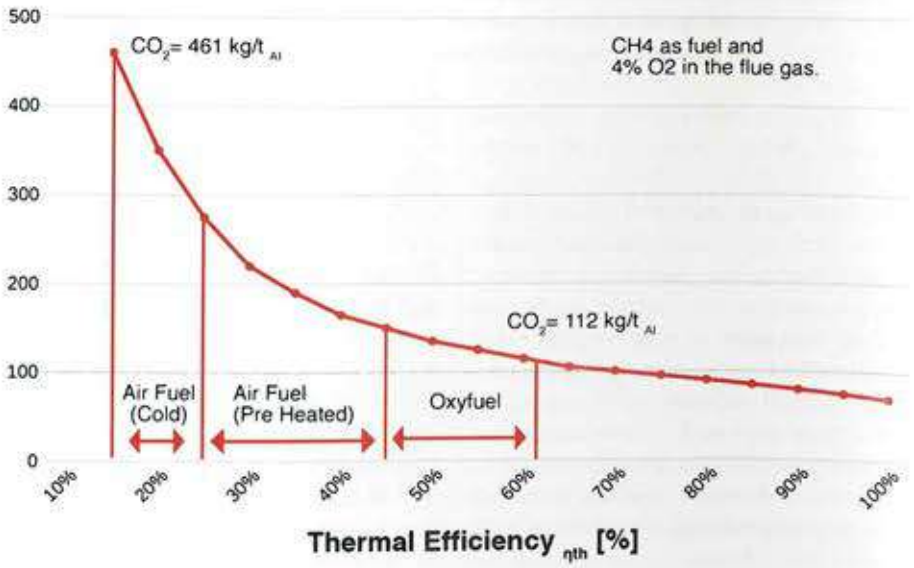
We design melting furnaces with ultra low NO_X regenerative burners or oxy-fuel technology. Using the regenerative burner system, the energy content of the waste gas is employed to pre-heat the air used in combustion to over 950°C. The formation of NO_X, which normally results with such high air preheating, is prevented by an appropriate lance layout or flame-less technology. The reduction in the energy requirement leads to a marked fall in CO_2 emissions and through the regulation of the gas-air ratio in line with the residual oxygen content.

Energy savings of up to 30% and in some cases even higher can be achieved when changing from air fuel to oxy-fuel. The nitrogen content in the air is close 79%; in air-fuel combustion the inert nitrogen is heated up from ambient to furnace temperature and then leaves the process with the exhaust fumes. This absorbs a substantial part of the energy. CO_2 emission are directly related to the quantity of fuel needed and what the fuel consists of. When the natural gas energy/t of metal is reduced then the CO_2 emissions are also reduced, since they are directly related to the fuel consumption. The figures below show the CO_2 emissions are being reduced while improving the thermal efficiency of combustion methane. Oxy-fuel processes can reach thermal efficiencies of more than 60%.

In our de-coating plant the cleaning of the material is made through a process based on heating of aluminum scrap pieces in a controlled oxygen atmosphere, through direct convective exchange with exhaust gas fumes which are recycled after they have been processed into a post-combustion chamber. The „dirty" material fed into the rotating drum meets a counter-current hot flow of gas with the necessary characteristics to carry out water evaporation, pyrolysis of organic substances and a good gasification of coke residue, thus

GROUP

wiping the base aluminum material without affecting its original characteristics. The flow, pyrolysis gas-rich, leaving through the loading chamber of the drum, is processed in a pair of dust extractor cyclones before being injected into the post combustion chamber so as to perform the complete oxidation of suspended organics and oxidize the CO content below the requested limits. With a dedicated heat exchanger, the temperature is reduced and the suitable quantity of gases is re-injected inside the rotary drum. The heat content of the gas is recovered producing heated combustion and partial re-circulating of these gases to control the inlet temperature in the rotary drum. The prolytic process and the subsequent melting phase leads to a total specific energy consumption of 70-75 Nm^3 CH_4/t (670-720 kWh/t) but drastically reduces the metal loss: this means that to produce the same final product quantity, using a de-coater, less scrap needs to be introduced and this is directly proportional to the total amount of fuel and CO_2 emissions. The main reasons for the increase in metal recovery are reduced melting time in the furnace and a „cleaner" materials charge. With a side-well furnace the continuous melting and the hot scrap discharged from the de-coating process can be melted quickly. The faster the scrap is melted the lower the losses will be. The surface coating on the scrap has a profound effect on the subsequent melt loss. In general, the higher the percentage of coating the higher the losses will be."



Energy-aware technologies in the extrusion process

Manufacturing facilities are among the highest consumers of energy. Efforts to improve energy efficiency are an increasing concern for many manufacturing facility engineering managers. This can be achieved by evaluating energy end end-uses.

For the last 20 years in all the international sites of the Group with a leading role in countless important innovations in process technology, simplification of the hydraulic press technology introduced by the PRESEZZI EXTRUSION ENERGY SAVING SYSTEM which offers a significant savings in the short and long terms. The system is based on the concept of "use the energy only when you really need it" and don't waste it in waiting activities or stand by conditions. New technologies allow the company to maintain its leadership in the market, and this benefit is acknowledged by clients also thanks to the presence of solutions which always keep abreast with state-of-the-art technology and the creation of original solutions aligned with new production requirements, which are rapidly evolving for the aluminium, copper and brass alloy application fields. The system is based on two fundamental principles: savings and technological innovation. The savings concept does not only imply energy saving, but also a lower number of components needed for its operation which make press production and setup leaner while at the same time ensuring that the machine is less subject to downtimes and maintenance.

The same concept was transferred to other parts of the plant where hydraulic power is used, machines like the stretcher that is hydraulically powered but with long periods on stand-by, have been optimized for the maximum reduction of energy consumption. Other machine in the line were transformed into fully powered movements based on the concept of "use the energy only when you really need it".

Presezzi Extrusion considered a typical extrusion plant and it was thoroughly studied from an energy point of view. Fully familiar with every phase of the working process including the machines and its buffers, Presezzi knows the waiting times for each job in the various buffers, the processing times and the energy readings for all the machines

These phases have been repeated and have allowed us to clearly understand the behavior of the system Presezzi has taken into consideration in order to find solutions to implement the subsequent cycles. Therefore, Presezzi has created energy-aware technologies validated during experiments and after an analysis of the results.

Subsequently another groundbreaking ideas have led to the engineering of a special product for billet heating using the magnetic effect generated by permanent magnet rotation around the metal to be heated.

ZPE – *Zero Pollution Energy* – is the new revolutionary and patented aluminum or non-ferrous material billets heating system entirely developed by Presezzi Extrusion. Thanks to its low energy consumption the ZPE allows huge energy savings compared to equivalent systems using induction heating.

Presezzi considers it as the most innovative system presented on the market in the last few decades and Presezzi is convinced that it will revolutionize the heating systems used up to now.