ECOSHAFT® environmentally friendly and economically sound scrap preheating – to usher a new era

We are proud to announce a new era where scrap preheating becomes profitable. The two-chamber scrap preheating system consists of two chambers – one chamber for scrap 'cleaning', where the cold scrap is warmed to approx. 400°C and a second chamber where the scrap is heated-up to 900°C. In the first chamber the pollutions (coat, paint, oil, grease, plastics, etc.) and chemical reactions are burning-off and help to warm the scrap. The other chamber, where the scrap are heated-up by the off-gas and by the reheating burners, is called the preheating zone. Here the cracked compounds and pollutions are incinerated.

The two-chamber system allows to make full use of the sensible heat and bound energy in the off-gas. For the first time a charging and preheating system takes care of the reaction of the pollutions and the chemical reactions inherent to the scrap.

The chart at the right hand shows some activity at the EAF, arcing is hidden for better visibility, and at the ECOSHAFT®: the orange, grey, blue and yellow curve show the temperature at different areas of the second chamber, the preheating container; the green and light blue curve show the exit temperature at the first chamber, the by-pass container. The black balloons represent the coarse carbon addition, the brown balloons represent the fine carbon injection. The stretched-out lines are indicating

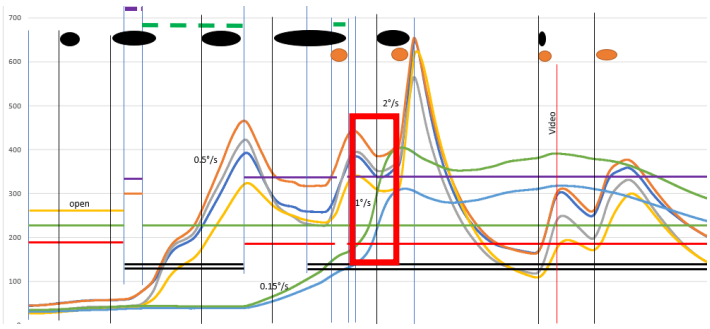

Figure 1 / Activity diagram EAF/ECOSHAFT®

dampers being open. Various dampers are needed to direct the off-gas flow during preheating.

The marked area in the above diagram, here in an enlarged presentation shows the proof that the chemical reactions of the pollutants, assumed to be 120 kWh/t[1], are happening **inside the scrap preheating** and do not deflagrate above the furnace (open roof for charging) or somewhere in the off-gas duct at the shafts (even the newest ones).

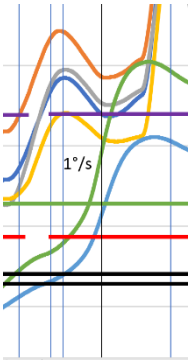

Figure 2 / chemical reaction

On the other hand that also proofs that while internally combusting (from 180°C to 400°C without external influence with a gradient of 1°/s (as predicted)), the by-products can be incinerated by the reheating burners at the entrance to the second chamber, which again supports the preheating of the scrap.

As mentioned, the two chamber system allows to use the heat and the bound energy (CO → CO_2) in the off-gas to the maximum. The use of the heat is mainly depending of the residence time of the hot medium in the exchanger area. The longer the hot medium can interact with the colder medium, the scrap, the better the efficiency and the closer the temperature of the second medium to the exit temperature of the first medium. The residence time is depending on the volume of the containers and the amount of the off-gas. The amount of the off-gas is a function of the oxygen and gas amount fed to the furnace and the intakes at necessary openings as well as the unwanted leaks. The necessary opening and the leaks can be influenced by the design. The slag door and the electrode holes can be sealed by air curtains. Assumed that the leaks are minimized by design, then their amount is a question of maintenance. By tightening the furnace as good as possible, the off-gas amount can be reduced, with the result that the flow speed in the chambers are as low as 1-2 m/s. Under these conditions the energy transfer of the off-gas heat, the reactions of the pollutants, and the bound energy reaction will happen within the scrap at the by-pass container; and at the preheating container the incineration of the cracked compounds gets enough time to happen.

ECOSHAFT® – uses the furnace energy to the maximum – a step toward a safe future – a step toward green steel recycling – for the sake of the environment and for the benefit of the steel plant.

Need more information, don't hesitate to contact us, info@eco-eag.com

www.eco-eag.com

[1] Thermodynamic analysis of EAF energy efficiency, H. Pfeifer, M. Kirschen, 2002