

New equipment necessity of aluminium melting and holding furnaces

As a result of long-term research, the R&D centre of Sistem Teknik has completed a project developed to make aluminium melting and holding furnaces environmentally friendlier and safer. When the scrap charged to aluminium melting furnaces has different chemical alloys and variable temperatures during melting, it can cause oxidation and therefore dross formation. The stirring process makes the temperature of molten metal more homogeneous. Preventing overheating of the molten metal bath surface significantly reduces surface oxidation and minimizes dross formation, which is a major challenge with aluminium furnaces.

In the current system, two conventional methods are used to ensure homogeneity. One is to create bubbles with nitrogen gas supplied through a pipe from the furnace door and thus provide the required mixture, while the other is to open the furnace door and provide the mixture by using a ladle. Both of these methods, however, result in oxidation and a large amount of dross formation. When molten aluminium comes into contact with air, it oxidizes, resulting in the formation of dross and metal loss.

Sistem Teknik ensured the homogeneity of both temperature between top to bottom in the furnace and the homogeneity of chemical composition with this project. By stirring liquid aluminium with an electromagnetic stirrer at the desired speed without using any gas mixture and without opening the furnace door, dross formation and metal loss are greatly reduced as well as the energy consumption. As a result, unexpected furnace breakdowns are less likely because maintenance time is easier to be detected.

The working principle of the electromagnetic stirrer is as follows: the electromagnetic stirrer, which is located under the aluminium melting or holding furnaces, is lifted to the niche beneath the furnace. With this method, a magnetic field is created by inductors, and the stirring process is provided without any human intervention or door openings. This generated magnetic field's flow rate and direction can be adjusted to the desired level.

The cold aluminium located at the bottom of the molten aluminium bath is moved to the surface by stirring through this magnetic field. The provided homogeneity of chemical



Stirring process in the aluminium bath by Sistem Teknik-designed electromagnetic stirrer

composition and homogenous temperature distribution of the aluminium bath significantly reduce the error rate in experiments and analyses.

Advantages of electromagnetic stirrers

The advantages of the electromagnetic stirrer are not limited to these. Since the stirring process is no longer controlled manually, the quality becomes independent from human, and flow control is provided because this system can generate a magnetic field of various frequencies. Besides all this, preventing overheating and dross formation prolongs the refractory's service life. In addition, the melting rate of the furnace will significantly increase due to the reduction of temperature differences between the surface and bottom of the molten aluminium bath. All of the previously mentioned benefits of electromagnetic stirrer reduce the cycle time, skimming time, and energy consumption during the melting process.

Sistem Teknik took temperature measurements before and after stirring in one of its melting furnaces with a capacity of 30 tonnes

	Before stirring	After stirring
Under-bath temperature	669 °C	745 °C
Top-bath temperature	779 °C	765 °C
Coil temperature	34 °C	63 °C

located on the customer's site to evaluate the performance of the electromagnetic stirrer. According to the findings, the temperature difference between the bottom and the sur-

face of the aluminium bath decreased from 110 °C to 20 °C as shown in the table. This demonstrates that the stirring process ensures the homogenous temperature distribution of the molten aluminium. On the other hand, the coil temperature was measured at 63 °C after the air cooled electromagnetic stirrer working for 30 minutes. For working circumstances of copper isolated with glass fibre embedded with F class resin, this temperature is adequate.

Measurements also revealed a 16% increase in melting rate and a 3% decrease in natural gas consumption. The stirrer enabled more aluminium to be melted in less time with less resource consumption, while the stirring process reduced the rate of dross formation and metal loss.

Energy consumption reduced, and melting rate improved

In addition to these findings, the time required to keep the furnace door open has been reduced, as well as the electricity consumption while the melting rate has improved. Using electromagnetic stirrers to optimize energy consumption, reduce carbon emissions, shorten the melting period, and reduce metal loss due to dross formation is extremely beneficial. Indeed, it has become a necessity in the aluminium industry.

Sistem Teknik will be exhibiting at the ALUMINIUM Show in Düsseldorf from 27 to 29 September 2022, Stand 6F71. ■