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INDUSTRIAL EXPERIMENTS REGARDING THE STEEL TEMPERATURE ADJUSTMENT POSSIBILITIES AT CONTINUOUS CASTING

Erika Ardelean
University Politehnica Timisoara,
Revolutiei, no.5, 331128, Hunedoara,
Romania

ABSTRACT
The paper present some researches in order to obtain thermoisolating and covering powder used in tundish of the continuous casting installations. This powder are made using different waste came from the siderurgic industry, energetic industry such as: thermocentral ashes, furnace slag, B.C.A. scraps, limestone, calcinated soda, fluorine, raw dolomite, graphite powder. The obtained powder must have a faster melting speed and a lower melting temperature; it doesn't impurity the steel and diminished of the heat losses through radiation.
The paper present as well as the designed experimental installation made for addition of this powder and the result obtained by using the powder in continuous casting tundish.
Keywords: steel temperature, tundish powder, continuous casting

1. INTRODUCTION
A very important factor in what concerns the continuous casting and the quality of the obtained semi-finished products is the casting temperature of the steel.
The ideal solution would be that the steel to arrive in the crystallizing apparatus at a constant temperature in time, a little bit higher that the solidification temperature of the respective steel. This thing can't be completely done because the thermical losses during the casting reach important values, which imposes an overheating of the steel at melting, ensuring a sufficient temperature of the period of continuous casting. Taking into consideration the special features of the technological process, the temperature of the steel at the end of the elaboration is higher than in the case of casting into ingots.
If the temperature value is modified, that influence the ulterior parameters of influence: the casting speed, the primary and secondary cooling conditions (mainly in the way of increasing or decreasing the values for these parameters).
If the casting temperature is too high, it is necessary to sensibly lower the casting speed and a very intense secondary cooling, having as a consequence internal and surface imperfections, due to the thermic tensions, and as well a too high temperature of the steel increases the danger of puncturing the wire under the crystallizing apparatus. A lower casting temperature may lead to the obturation of the casting orifices of the tundish, especially in the case of thin sleb or of the small section billet, as well as to the surface imperfections. [1,2]

2. EXPERIMENTATIONS
I have study both cases, the second case been the subject of this paper.
Thus, I was made 5 recipes of thermoisolating and covering powder used in continuous casting tundish. For obtaining that powders I used some wastes present in Hunedoara country area – figure 1.

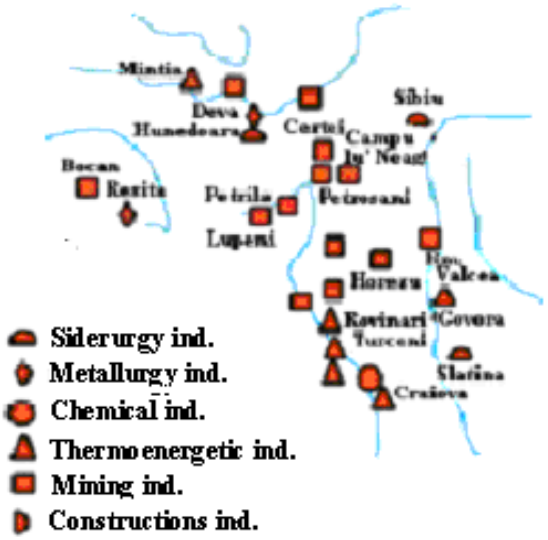

Figure 1. The main wastes deposit in Hunedoara area.

The waste, that came from the siderurgic industry, energetic industry was: thermocentral ashes, furnace slag, B.C.A. scraps, limestone, calcinated soda, fluorine, raw dolomite, graphite powder. The raw materials used for making the heat insulating powders for the tundish were chosen function of the following criteria: chemical composition; content of noxes; possibility of making the powders as mechanic mixes; cost price; expenses related to the processing. [3]

The experimental researches were made in the laboratory for Steel Metallurgy within the Faculty of Engineering Hunedoara. The way of carrying out the mixes (mixing formula) was made based on a technological fabrication flow, which foresaw the material grinding with the aid of a Kollergang mill, followed by a grain-size sorting made with the aid of a „Analysette 3" Fritsch vibrating sieving machine (the fraction used was less than 250μm); the material dosing was made based on the pre-established mixing formulae with the aid of a Sartorius technical balance and the homogenising was made with a homogenising barrel.

We experimented recipes ar the chemical composition is presented in table 1.

Table 1.Chemical composition of the recipes

Recipe no.	Chemical composition, [%]												
	C	SiO_2	CaO	MgO	Al_2O_3	Fe_2O_3	CaF_2	P_2O_5	Na_2O	K_2O	TiO_2	MnO	Al
R1	20,64	33,62	10,02	1,33	13,84	11,11	5,01	0,28	3,58	0,27	0,24	0,06	0,00
R2	18,58	34,47	12,69	2,35	12,68	9,69	4,01	0,24	0,72	0,35	0,24	0,02	4,06
R3	12,47	37,37	11,58	1,44	13,20	9,91	4,03	0,24	3,96	0,41	0,27	0,00	5,11
R4	15,38	37,82	11,21	1,92	14,80	11,67	2,98	0,29	1,29	0,34	0,26	0,02	2,02
R5	18,99	34,20	12,14	2,55	12,63	9,66	3,07	0,24	3,86	0,35	0,24	0,00	2,07

The powders obtained in the end were melted in a Tammann furnace with resistance, determining the melting temperature ranging between 1250-1350^{o}C through a contact thermometer and an optical radiation pyrometer. Also the spreading degree on a metallic plate and the behaviour of the experimental mixing formulae was similar with that of the standard powder.

Based of lab experiments, the conclusion conduct to selection the receipt no. 4, who are the best behaviors, reason to product these powders in biggest quantity, for industrial experimentation.

For industrial experiments, it was designed and made an installation for adding the covering powder in tundish. In present, at the most installations, adding of powder is made manual.

The experimental installation was provided with a screw transporter, with productivity as much 30kg/min – figure 2.

Figure 2. Experimental installation for adding covering and thermoisolating powder in tundish

Based on these preliminary results, we proceeding to make a 150kg quantities of powder, for two charge of steel casting experimentation. It was determinate just a high consumption of covering dust, amount 70kg/100 to continuous casting steel, related to an medium consumption of 60kg/100 to continuous casting steel, in case of etalon covering powder.

3. CONCLUSION

The paper propose a viable recipe of covering and thermoisolating powder, which bring beside anticipated technological effects (stabilization of steel temperature in tundish, protection of steel bath), also social, economic and ecological effects: saving of cost, jobs in case when a local company decide to make these powders and reducing pollution of local area.

To a 400.000 to steel capacity annually casting, value of investment (the initial investment for design and made installation) can by recovered after cast among 21,75% of annually casting production or in 3 month (for a production of 1200 to steel cast/day).

4. ACKNOWLEDGEMENTS

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