

Effect of Slag Removal on 60-Ton Top-Blowing Converter Performance

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The effect of intermediate slag removal on certain parameters of converter plant operation at Iron & Steel Works named after Petrovskiy is considered in present paper.

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Results and Discussion

The effect of intermediate slag removals on performance parameters of basic-oxygen converters as applied to conditions of PJSC "EVRAZ - Dnipropetrovsk Iron & Steel Works named after Petrovskiy" are considered in works [1, 2]. Till the end of 2008 this production method was the forced solution and applied, as a rule, at pig-iron treatment with silicon content more than 0.9 % and sulfur content more than 0.050 %. The share of melting with intermediate slag removal was usually in the range of 40-50 %, in some cases 60 %. At increase of steelmaking volumes to the level of 1230 thousand tons per year and more (2006 – 1328.2 thousand tons, 2007 – 1351.5 thousand tons), intermediate slag removal was the factor breaking the further growth of production as each slag removal lasted approximately 4 minutes. To eliminate this disadvantage various measures are tested, in particular, regulated charge smelting practice presented in work [2] is developed.

The situation radically changed in the end of 2008 when in the middle of December the blast furnace No. 5 (1033 m³) was shut down. As intermediate slag removal at other things being equal helps raise metal temperature in the end of blowing by 10-25 °C and lower hot metal share, in 2009 and further the production method with intermediate slag removal is used in all ironmaking irrespective of pig-iron chemical composition.

In 2009, the share of melting process with

intermediate slag removal made 96.7 % and remains at this level now. And melting process without slag removal takes place because of organizational reasons but has no effect on performance of oxygen converter shop. The parameters of production technology in 2008 and 2009 are compared in **Table 1**.

When melting with slag removal, the drop of specific consumption of hot metal was 34.8 kg/t of steel in 2008 because of: increase of imported lime carbonate with green coke approximately 10 % versus 30 %, increase in volumes and stabilization of scrap steel deliveries. Further drop of hot metal charge by 17.3 kg/t of steel in 2009 as compared to 2008 was reached also due to increase of melting to 32 % versus 1 %. In 2010, scrap preheating in the converter and lance of new design with two-row arrangement of nozzles was applied to ensure CO post-combustion to CO₂ in its working space. The specified measures helped reach the specific charge of hot metal 915 kg/t.

The specific charge of metal stock when melting with slag removal as shown in **Table 1** is more by 4.3 kg/t of steel and related to higher slag oxidation (by 1.44 %) and additional iron loss with removed slag. The benefit of production method with intermediate slag removal is possibility to increase the extent of sulfur removal by 4.2 %, especially at processing pig-iron with sulfur content more than 0.050 % due to slag renewal and higher basic capacity (3.41 versus 3.17).

Steelmaking

Table 1. Performance of oxygen converter shop

Parameters	Running period		
	2008	2009	Δ (2009-2008)
Steelmaking, t	<u>1085331</u>	<u>974652</u>	<u>-110679</u>
%	100	89.8	-10.2
Number of melting operations	18368	16502	-1866
Number of melting operations with slag removal, % from total number	57.1	96.7	+39.6
Specific consumption of hot iron, kg/t **)	<u>976.3</u>	<u>-</u>	<u>-</u>
	941.5	924.2	-17.3
Specific consumption of metal stock, kg/t (without account of ferroalloys)**)	<u>1111.3</u>	<u>-</u>	<u>-</u>
	1115.6	1115.4	-0.2
Degree of steel desulfurization, % **)	<u>8.3</u>	<u>-</u>	<u>-</u>
	12.5	12.8	+0.3
Converter lining resistance	1906	2060	+154

**) numerator – melting without slag removal, denominator – melting with slag removal

The problem of converter lining resistance increase for Iron & Steel Works named after Petrovskiy has been always of interest. It became even more urgent (more than in 5 times) when using periclase-carbonaceous refractories instead of periclase-spinel ones. In this sense, the effect of production method with intermediate slag removal on this parameter is obviously important. Comparison of results of oxygen converter shop operation in 2008 and 2009 allows concluding that lining resistance at slag removal, at least, does not decrease but even grows a little. This can be explained by smaller amount of hot metal in the charge, less amount of slag, its higher basic capacity, raise of efficiency of using magnesian briquettes, engineering solutions related to protection of furnace mouth lining. Decline in shop production in 2009 as compared to 2008 had a certain effect on lining resistance which enabled to take lining care measures: torkret process, backing run, slag skulling by means of nitrogen.

Conclusions

Wide application of production method with intermediate slag removal helps lower the specific charge of hot metal, increase sulfur removal degree without lining resistance weakening at Iron & Steel Works named after Petrovskiy.

References

1. V.B. Okhotskiy, Ya.L. Alperovich, V.I. Pishchida, et al. *Metallurgicheskaya i Gornorudnaya Promyshlennost*, 1997, No. 4, pp. 24-25.*
2. A.D. Zrazhevskiy, Ya.L. Alperovich, V.B. Okhotskiy, et al. *Proceedings of the 4-th Congresses of Steelmakers*, Moscow, October 7-10, 1996, Moscow, JSC "Chermetinformatsiya", 1997, pp. 63-65. *

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Влияние скачивания шлака на показатели работы 60-тонных конвертеров верхнего кислородного дутья

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