However if boron product is fed by an equipment onto the top of the slag after tapping the molten metal into ladle, this feeding system allows the crystal water of boron product to evaporate and escape into the stack. So in such a case there will be no risk of explosion due to crystal water of boron product.

Shortly there is no any risk of using boron product if it used properly. Many Turkish steel companies have used boron product for a long time without any complaint so far.

8) At which stage of steel production is boron product used?

The problematic disintegration of slag is primarily encountered in two areas. Firstly, in stainless steelmaking, where decarburisation slag is known as heavily disintegrate during cooling. Secondly EAF slag also display this behaviour, but to a lesser extent.

9) What are the virtues of boron product usage?

- Boron product offers a low melting point (900 °C) and so it helps to reduce viscosity of the slag.
- Less slag dust and so less filter bag consumption.
- Easier slag handling in the plant
- Revenue from saleable slag as a filling material.
- Savings on slag treatment costs
- Elimination of environmental concerns.

Note: If you encounter any problem during the using of our product (boron product) in ladle furnace, please consult us.
Questions and Answers on Usage of Boron Product in Steel Production

During steel production, lime (CaO) is used as a fluxing agent for slagmaking in the ladle furnace (LF) in order to eliminate impurities in steel.

The slag produced in the ladle furnace is composed mainly of 2CaO·SiO$_2$, and this air-cooled slag disintegrates into a fine powder.

This slag powder is hydrophobic and hence does not get wet and is not easily compressible. Therefore, it causes problems in storage and transportation leading to environmental concerns and additional costs.

Increasing environmental awareness in recent years has forced metallurgical companies to tackle various slag issues. Slag disintegration during cooling is one of the main issues, as it not only creates dust problems but also complicates the utilization of slag in construction applications.

Usage of boron product is proving to be the key in solving this problem and boron product prevents the slag from powdering in the cooling of slag.

1) What is the philosophy of that event?

2CaO·SiO$_2$ of ladle furnace slag goes through a crystal transformation during the cooling of hot slag. Such a crystal transformation leads to about 12 % volume expansion which causes high internal stresses in the slag and results in powdering of the slag. The resulting particle sizes are typically not larger than 100μm.

The addition of boron product prevents crystal transformation and the slag from powdering and thus it changes the slag from a crumbly and friable structure to a compact structure.

The bulk density of the slag increases from 1.36 in the powder state to 2.64 ton/m$^3$ in the compact state.

So this compact slag can then be stored easily and used as filling material.

2) At which stage should we add boron product to the ladle furnace?

Boron product should be added to the ladle furnace after addition of deoxidation elements (Al, Si etc.). Otherwise deoxidation elements will react with B$_2$O$_3$ of boron product to result elemental boron (B) in which case more elemental boron (B) is likely to pass to steel. As known, more than 30 ppm boron (B) in steel has an adverse effect on steel structure. In Turkey eight steel producers have used boron product in ladle furnace slag and the boron content of the steel produced by all of them were found to be 7 – 9 ppm and hence they were all satisfied with using boron product.

After addition of boron product into the ladle slag, 10 minutes is enough for homogenous diffusion of boron product throughout slag.

3) When this product is added to LF, does slag convert immediately to a thicker state? Is there any effect on slag fluidity after casting molten metal? If it is so, then it will be very difficult to deslag of ladle after casting.

Boron product makes ladle furnace slag slightly more fluid because addition of it decreases the melting temperature of slag (not so much). So slag will not be converted immediately to a thicker state. It is thought that deslagging of the ladle will not be difficult, as some steel plant technicians reported that after using boron product they had both much cleaner ladle and reduced bag filter consumption in the dust collection system due to generation of less dust.

4) Can this compact slag be used in EAF? Will it cause any adverse effect on EAF refractory?

Due to high content of CaO, compact slag can be reused in EAF. But caution will be required in this matter because compact slag contains 1 % B$_2$O$_3$, by weight of slag, if deoxidation elements are used in arc furnace, as mentioned above, it could result in more boron in steel. The usage of compact slag can be increased gradually in arc furnace instead of lime addition.

For example, in the first step, 20 % of the lime used in the ladle furnace should be replaced with compact slag and in the second and the third step, 30 % and then 40 % of lime should be replaced with compact slag while checking the boron content of the steel at each step.

There will not be any adverse effect on EAF refractory since the boron oxide (B$_2$O$_3$) amount in the slag is only 1 %.

5) Is there cost advantage with usage of boron product?

As a result compact slag can help producers to save money. Of course the amount of saving depends on the local conditions. (i.e. local price and availability)

6) Is MSDS of boron product available?

Yes it is available.

7) Is there any risk with usage of boron product in ladle furnace due to its crystal water?

In the case of feeding boron product which has crystal water into the ladle furnace before/with the tapping of molten metal, the crystal water of boron product cannot escape into stack. This, then, causes explosion in the ladle.