

Improve Blast Furnace Safety, Operational Stability and Hearth Wall Preservation With Tailored Taphole Clay Technologies

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Keywords: Taphole clay, Blast furnace, Refractory, Ironmaking, Taphole.

INTRODUCTION

Blast furnace taphole clays are refractory materials made of alumina, silica, silicon carbide, silicon nitride and carbon ($\text{Al}_2\text{O}_3\text{-SiO}_2\text{-SiC-Si}_3\text{N}_4\text{-C}$), bonded by tar, resin and/or synthetic oil, plastic at the temperatures of use and used to seal blast furnace tapholes at the end of tapping.¹ Their main functions may be divided in four²: (1) after plugging, assure the closure of the blast furnace taphole; (2) at the moment of tapping, allow its drilling; (3) assure a regular drainage of the hot metal and slag; and (4) contribute to the hearth refractory protection (“mushroom”) in the taphole region.

To ensure that the material performs its functions properly, the taphole clay must have the following characteristics:³

- Good compatibility with the environment;
- Good aging in stock;
- Good plasticity during injection;
- Fast hardening after injection;
- Good permeability;
- Good adhesion on the remaining taphole clay presented in the inner regions of the taphole;
- Be compatible with the internal refractory structure of the blast furnace;
- Relatively easy to drill during taphole opening;
- Good resistance to erosion and corrosion by molten metal and slag.

Besides that, there is the need to use a high-quality taphole clay tailored to each blast furnace. Its development project must have updated technology, and the selection and control of raw materials and production processes must be rigid, in order to guarantee the homogeneity of properties and performance of the produced batches.⁴ Each taphole clay is developed specifically for each blast furnace, as it depends on the design and operational parameters of the equipment.

However, besides a high-quality tailored product, special taphole clays for specific applications can also be used together with the standard material to improve even more blast furnace environment safety, operational stability and hearth wall preservation. Innovative technologies have been developed for specific applications such as: crack sealing, taphole length recovery, consecutive taps, hot spots and ecofriendly refractories. The implementation of these taphole clays in the market have contributed to better blast furnace operation and campaign extension.

SPECIAL TAPHOLE CLAY TECHNOLOGIES

Crack Sealing

Throughout the blast furnace campaign, cracks may be formed near the taphole and along the mushroom. In order to have a more efficient filling of these cracks, special taphole clays with high plasticity and high content of fine particles and carbon sources were developed. An example of a taphole with cracks before and after the injection of a taphole clay for crack sealing can be seen in Figure 1.