Glazed Panel Installed Precast Block for Coke Oven Doors

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Abstract

Adhesion and penetration of coal tar are typical issues of precast blocks used for coke oven doors. Glazing on the block surface is an established technology for preventing such adhesion and penetration. We have developed glazed panel installed precast blocks by applying this glazing technology. They are performing well in actual applications.

1. Introduction

Large precast blocks are widely used for coke oven doors. Adhesion and penetration of coal tar are typical issues of these blocks during usage. Excessive adhesion of coal tar affects the sealing of the door, which causes gas leakages from the oven resulting in environmental problems. Therefore, operators have to remove adhered coal tar periodically, generally, in uncomfortable working conditions.

It is known that glazing is one of the effective countermeasures for reducing the adhesion and penetration of coal tar. We have already developed glazed precast blocks using one of our low cement-cordierite based castables named "CST-A53", of which the thermal spalling resistance is excellent due to its low thermal expansion property[1]. As a new configuration for glazed blocks, we have developed glazed panel installed precast blocks. Glazed panels are installed in side faces of an extra large block so that glazed surfaces of panels face the inside of the coke oven.

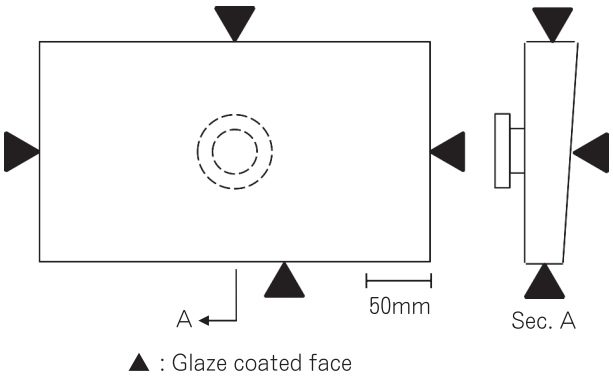

Fig. 1 Shape of glaze coated panel.

2. Configuration of Developed Precast Blocks

The shape of a glazed panel is shown in Fig. 1. Of course, glazed panels were burned in order to melt the glaze before installation in the precast blocks. We added an anchor on the back face of the panels so that the panel can fastened tightly by the body of the large block. The configuration and an appearance of developed block are shown in Fig. 2 and Fig. 3. CST-A53 was used for

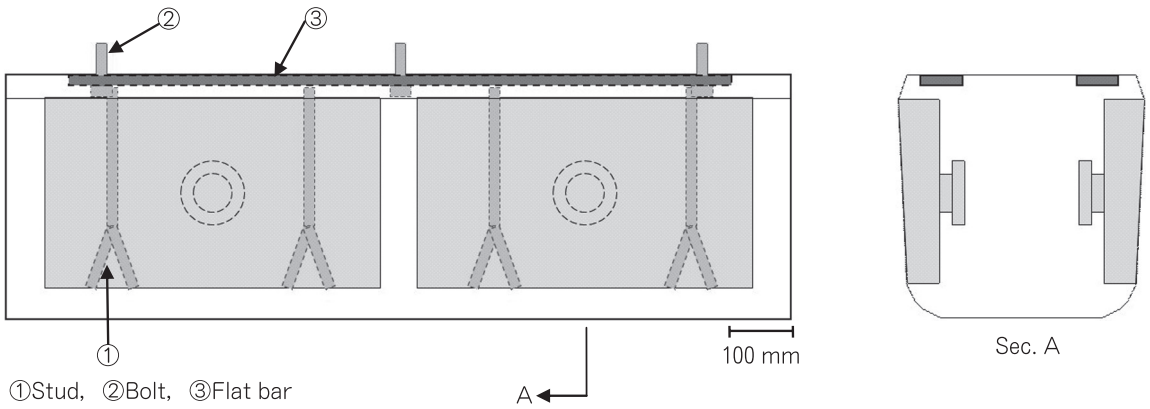

Fig. 2 Configuration of glaze coated panel installed block for coke oven door.

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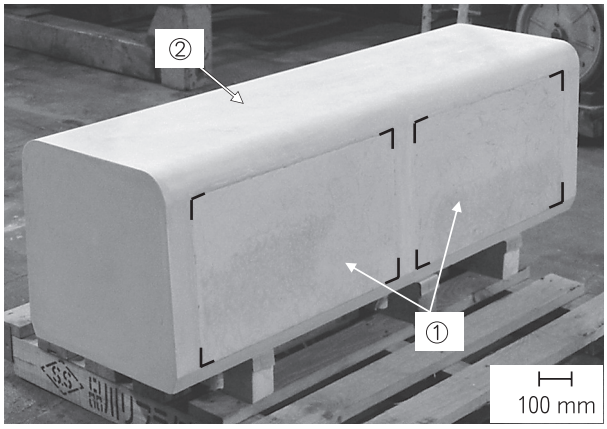


① Glaze coated panel
② Main body of block

Fig. 3 Appearance of glaze coated panel installed block.

making both the panels and the body of precast blocks.

3. Unity Between the Panels and the Body of Blocks

There was a concern that the installed panels would peel off or spall off during usage as a result of separating from the body of blocks. In order to confirm the unity between the panels and the body of a block, we conducted a spalling test and a compression test.

3. 1 Experimental method

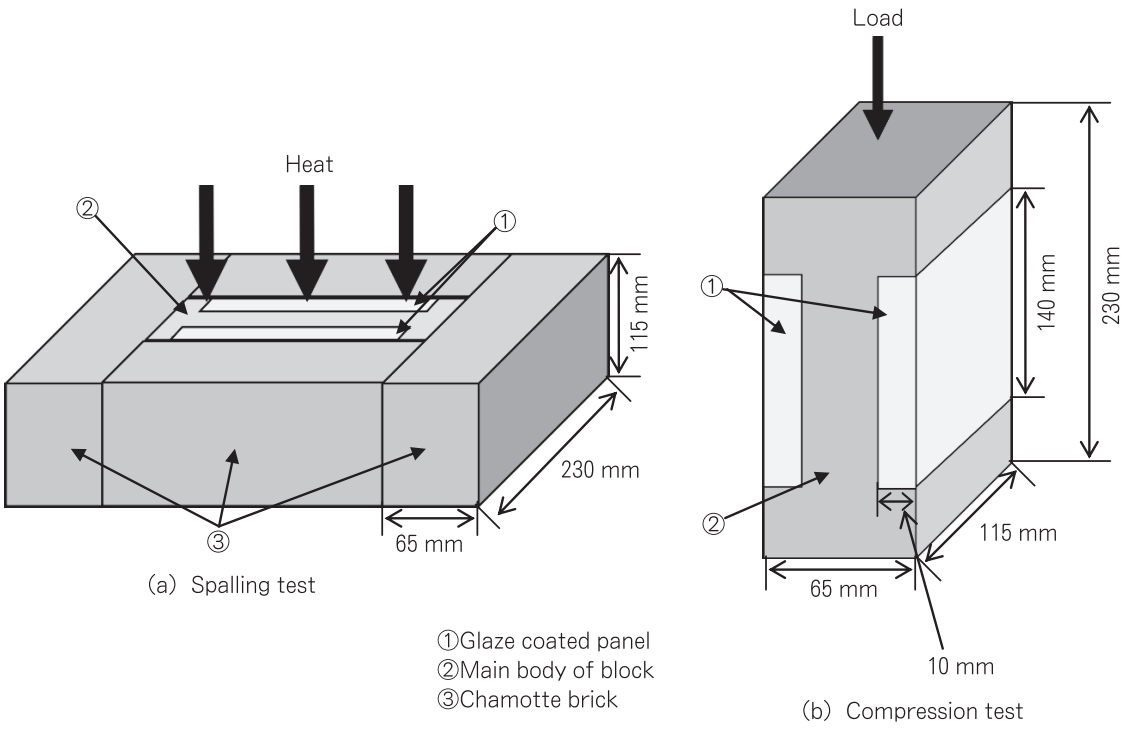
The schematic images of these tests are shown in Fig. 4. The sample size was 230×115×65mm and two panels were installed in both wide faces. In the spalling test, the sample was heated from the side for 10 minutes at 1200℃, and then, air cooled for 10 minutes. We repeated such heating/cooling repetitions 9 times. In the compression test, with and without panel samples were compared with the compression being loaded from one of the narrow faces.

3. 2 Test results

The post test appearances of the samples are shown in Fig. 5. Measured fracture loads are compared in Table 1. There was no sign of separation between the panels and the main body after the spalling test. After the compression test, the fracture seemed to have started from the corner of the installed panel to the top face of the main body. There was a gap due to the separation between the panel and the main body. However, as shown in Table 1, the compressive strength of the sample with panels was higher than that without a panel. Accordingly, we concluded that the unity of the panels and the body of blocks is acceptable.

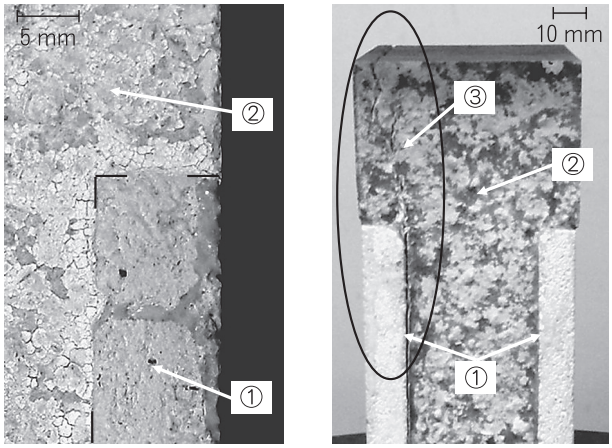
4. Actual Application

Glazed panel installed blocks were put into practical usage in an actual coke oven. Appearances of the blocks with and without glazed panels are shown in Fig. 6. In actual operation, prior to pushing out the carbonized coke, doors on both sides are removed by the door lifter cars mounted on the pushing machine and the coke guide



①Glaze coated panel
②Main body of block
③Chamotte brick

Fig. 4 Schematic images of spalling test and compression test.



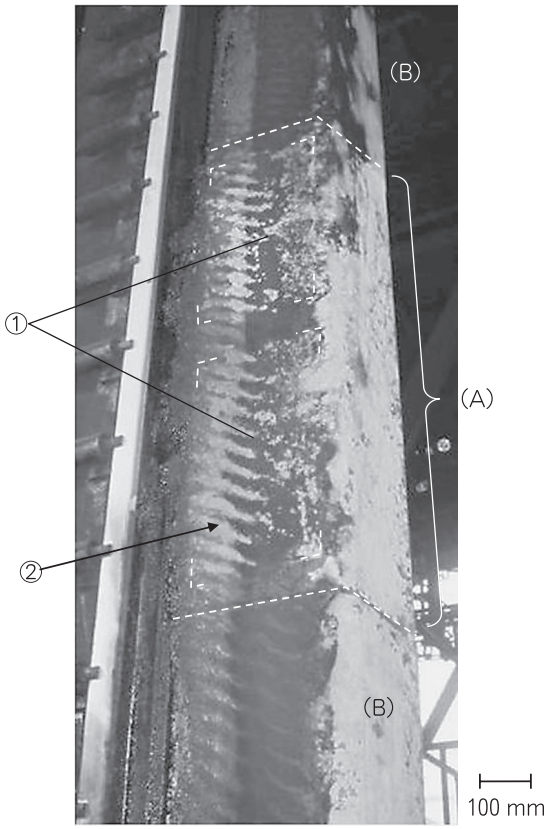
(a) Spalling test (b) Compression test

①Glaze coated panel
②Main body of block
③Crack

Fig. 5 Appearances of samples after the tests.

Table 1 Fracture load of the brocks with and without panel

	Block with panel	Block without panel
Fracture load / kN	203.5	186.1



(A) Block with panel
(B) Block without panel
① Glaze coated panel
② Trace of door cleaner

Fig. 6 Appearance of blocks with and without glaze coated panel during practical usage.

car. Coal tar adhering to the side surfaces of the doors is automatically cleaned by the rotating motion door cleaners, which move up and down along the side surfaces of the doors. As shown in Fig. 6, traces of the cleaner were recognized clearly on the surface of the glazed panels installed blocks and the glazed surface of blocks could be seen, which meant the coal tar was removed effectively. On the other hand, there were still much coal tar adhering to the surface of the blocks without glazed panels. The glazed panel installed blocks are still in service.

5. Conclusion

We have developed glazed panel installed precast blocks for reducing the strong adhesion of coal tar on the surface of coke oven door blocks. The developed blocks are performing well in actual operation.

Reference

1) M. Kataoka and M. Mori ; Shinagawa Technical Report, **49**, 29 (2006)