acid, 5% acetic acid and a combination of 5% lactic and 5% acetic acids, respectively. The pH solutions were not maintained during the experiment.

Degradation of mortars was evaluated by determination of the compressive and flexural strengths, mass and dimensional characteristics of the specimens immersed in acid solutions for 6 months. Also, pH and major element concentrations (Ca, Si, Al, Fe and Mg), were monitored over time.

The obtained results allowed a classification of the mortars chemical resistance to the organic acid attack depending on binder type and strength of the acid. Therefore, the mortars prepared with CEM II/B-V (S-V) and CEM V/A(S-V) shown a better chemical stability compared to CEM II/A-S and CEM I. Lactic acid attack caused highest degradation in the mortar containing CEM I. Intensity of the acetic acid attack is closed to the lactic acid, while the combination of the two acids had an weaker aggressiveness.

Keywords: cement, organic acid attack, durability

FROM RAW MATERIAL CLAY TO HIGH-TECH BRICK - CURRENT TRENDS FROM GERMANY

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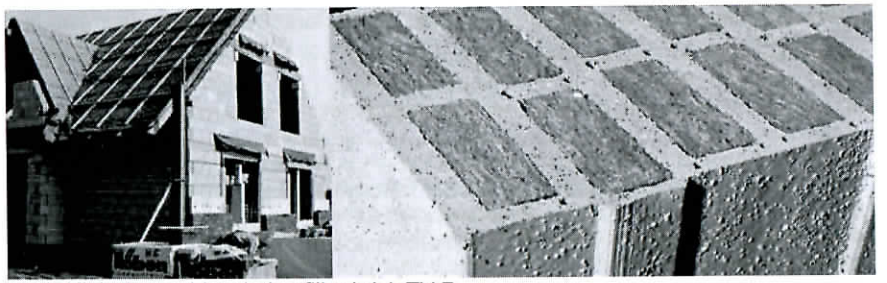

>> 1: High-thermal-insulating filler brick TV 7

Abstract

The global discussion about climate change and the measures of reducing CO_2-emission are a great challenge for the clay brick and tile industry. In spite of the significantly higher price of the highly thermal-insulating vertically perforated clay units the sale is booming, while the sales of traditional bricks are stagnated on low price levels. The question is, how can the technological leap from traditional brick to a high-tech brick, with a heat conductivity of W = 0,07 W/mK, be managed? Which demands will be made on the resources? Which facility management will be required? Current trends from Germany present an interesting perspective for the future market of the clay brick and tile industry.

Raw materials for highly thermal-insulating bricks

Usually traditional bricks are made of factory-owned clay tile deposits. In contrast, the consumption of raw materials in the production of highly thermal-insulating vertically perforated clay units is more complex. Distinctly plastic special clays which are mixed with organic and inorganic pore-forming agents to a large extent, are served as basic raw materials. The ambition aim is to reach a bulk density under 1,30 g/cm^3. Typical organic pore-forming agents are papermaking sludge, saw dust, polystyrene, coal washery tailings. Typical inorganic pore-forming agents are: Limestone powder, perlite, Kieselguhr, mineral wool, aluminum hydroxide.

The greatest challenge based on the raw material arises from the correlation between bulk density and compressive strength. The result is: by lowering the bulk density, the compressive strength also decreases. With a clever combination of the raw materials this effect can be avoided. Another problem is the high energy input, which is caused by organic pore-forming agents. Mixed pore-forming agents counteract the unregulated burning behavior in the heating zone of a tunnel kiln. The use of mineral wool, and aluminum hydroxide gains increasing significance.

General raw material requirements

All raw materials have to be still available for a long time and the quality must be homogenous as well as they have to be stable in price. The clays need a distinct plasticity to integrate the pore-forming agents. To produce highly detailed hole geometries clays must be finely granulated and free of coarse-grained properties. A very low bulk density and heat conductivity of clay offsets should be aspire with using dolomitic marl and kaoline. The pore-forming agents must have a consistent high porosity-effect. They may not be dangerous for the environment and do not cause contamination of the tile. Sawdust, papermaking sludge, polystyrene and perlite have proven to be particularly successful.

Plant-technical conditions

The multiple uses of raw materials require a large and covered raw material storage. This includes suitable silos for dust-free storage of fine-grained materials such as limestone powder or fine perlite. Raw materials must accurately regulate over a sufficient number of box feeders and are then prepared into a homogeneous plastic mass. By using a combined use of suitable organic pore-forming agents the clay brick and tile industry need a thermal post-combustion. After drying or better after firing the tile must be surface-grounded with a mechanical grinding machine. For extremely low thermal conductivities the content of holes in the brick is to be filled with special insulating materials such as perlite or mineral wool. This will require robotized filling systems. And only then it is complete - the high-tech brick, which delivers 101,000 results in 0.25 seconds in Google Germany.