

QUALITY IMPROVEMENT

UDC 666.3.032.62

CLAY MODIFIER ACTIVATION FOR CERAMIC BRICK BY ULTRASONIC EXTRUSION

G. R. Faseeva,¹ R. M. Nafikov,¹ S. E. Lapuk,¹ A. G. Kiyamov,¹ Yu. A. Zakharov,^{1,4}
R. R. Kabirov,² L. N. Garipov,² N. M. Lyadov,³ and I. A. Faizrahmanov³

Translated from *Steklo i Keramika*, No. 12, pp. 31 – 37, December, 2017.

The properties of ceramic are studied in the case where clay is modified by adding small amounts of glass fiber in the process of ultrasonic extrusion of laboratory samples. Ultrasound increases the strengthening action of the modifier. It consolidates the batch and orients its elongated particles along the direction of extrusion. After firing the modifier particles become hollow concretions-geodes which have a polycrystalline shell comprised of anorthite and are filled with needle-shaped crystals. The proposed method of extrusion increases the accuracy and informativeness of tests performed on modified clays.

Key words: ultrasonic extrusion, ceramic brick, clay modifier.

Different technogenic wastes, so-called modifiers, are added usually in amounts 5 – 15% (weight content)⁵ to the primary raw material in order to improve brick quality, for example, strength [1 – 6]. The mix is perfected beforehand under laboratory conditions by fabricating and testing miniature ceramic samples. However, mechanical stresses, which always appear during the extrusion of conventional rectangular bars, engender defects (cracks). This makes it difficult to determine the strengthening action of an additive and, correspondingly, its optimal amount. As a result very promising modifiers are not adopted in the commercial production of building ceramic.

In [7, 8] we described novel ultrasonic draw dies for extruding cylindrical and rectangular parts that significantly increase the precision of fabrication compared with the standard draw die for a laboratory extruder. It was found that ultrasonic vibrational action by the walls of the draw die on batch comprised of a mixture of different clays results in additional ordering of the samples (to 30%) owing to compac-

tion of the batch in the molded green part. In this connection it is of interest to check the efficiency of our methodological approach when the batch is modified by small amounts of additives.

Glass wastes added in definite amounts always strengthen brick. The mechanism of this interaction with batch during molding without ultrasound has been well studied [9 – 13]. Glass melts during firing, which binds ceramic crystallites together. In addition, new mineral phases are formed. For this reason, for the present investigation we pick precisely this modifier in the form of comminuted glass-fiber wastes.

The aim of this work was to evaluate a laboratory method of testing low-modified clays for brick using ultrasonic extrusion of samples and to investigate the effect of ultrasound on the effectiveness of the modifier.

EXPERIMENTAL PART

Raw material preparation. The primary raw material was red-burning polymineral clay from the Alekseevsoe deposit and clayey marl from the Salmanovskoe deposit (Republic of Tatarstan), which are used at Alekseevskaya Keramika JSC in the production of ivory face brick. Waste from the Elabuga plant was used as a modifier: glass fiber – free-flowing gray powder in the form of short fragments and

¹ Kazan (Privolzhskii) Federal University, Kazan, Russia.

² Alekseevskaya Keramika JSC, Alekseevskoe township, Alekseevskii Rayon, Tatarstan, Russia.

³ E. K. Zavoiskii Kazan Physicotechnical Institute, Kazan Scientific Center, Russian Academy of Sciences, Kazan, Russia.

⁴ E-mail: zaha1964@yandex.ru.

⁵ Here and below, content by weight, %, unless otherwise specified.