New Technology for Bricks and Blocks Production Based on Clay and Admixtures

Over the last decade there has been a growing interest in the production of building bricks and blocks without high temperature firing due to the good economic and environmental achievements while at the same time reducing the manufactoring operations. The newly developed methods and technologies aim at obtaining building products' possessing specifications equal to those of the conventional fired analogues (based on clay only and fired at high temperature).

The binding phase of the new products occurs as a result of the chemical reaction between the clayey substance of the mass and the admixtures in presence of water. Different admixtures can be used – fly ash, ground granulated blast furnace slag, cement, lime etc.

The newly developed technology is proposed by a team of researchers working at Sofia University "St. Kliment Ohridski", University of Chemical Technology and Metallurgy and Bulgarian Academy of Sciences. The technology is based on fine grained sandy or sandy-silty soils with moderate content of clayey substance and low quantity of organic matter with lime and gypsum as admixtures. The strength of the products increases with the amount of the silica gel, formed by the interaction of the clay minerals with lime, and the formation of ettringite.

The study of the kinetics and mechanism of the chemical interactions in the clay-lime-gypsum-water system made it possible to define the conditions for promoting the reaction giving products with appropriate properties. Main attention is paid to the kinetics of the interaction between lime and clay minerals and especially on the ettringite formation.

The results can be summarized as follows: (1) clays with higher reactivity to lime should be used to achieve better product performance; (2) activators of the ettringite reaction are needed to prevent the ettringite expansion.

The quantity of the admixtures and water is evaluated and optimized as well as the mellowing time before moulding and also the influence of other factors with impact on the mechanical properties of the bricks.

The proposed method and technology comprise the following steps: ∗dosing of admixtures to the mass, ∗dry mixing, ∗moistening, ∗plasticizing,∗mellowing, ∗moulding by extrusion, ∗curing in humid atmosphere for 3 – 4 weeks at temperature 20 – 30°C and ∗drying in open air.

The workability of the technology is verified by semi-pilot scale study. Bricks of standard size 25/12/6.5 cm are produced having the following technical specifications:

- total water absorption – 14 ÷22 vol%;
- initial rate of water absorption – 0.7 to 1.3 kg/m^2.min;
- linear expansion after extrusion – 1.5 – 2 % (within 36 to 48 h);
- linear expansion final (dried bricks) – 0.3 – 0.7%;
- compressive strength (dried bricks) – 8 – 10 MPa;
- compressive strength (not dried) – 5 – 7 MPa;
- flexural strength (dried bricks) – 1.8 – 2.4 MPa.

The applicability of the proposed technology could be proved with some investments in an operating brick factory within a trial production run. The newly developed technology is protected by a patent.

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