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**ENGOBED CERAMICS FOR THE BUILDING INDUSTRY WITH  
ELEMENTS OF THREE-DIMENSIONAL DECORATION**

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Engobes are widely used in the production of facing tiles, porcelain stoneware and ceramic bricks. The relevance of creating engobe coatings is due to the need to improve the aesthetic, operational and technical characteristics of building ceramics [1]. Such coatings provide increased resistance to mechanical damage, environmental influences, water absorption and cracking [2], and also contribute to the creation of materials with an improved design that meets modern requirements of architecture and construction.

The vast majority of engobes are clay-based composite blends that are applied in a thin layer to the front of products and fired to set. Engobes are produced by fine wet grinding in ball mills in the form of a slip that is applied to products by spraying and watering [3]. However, this technology is very sensitive to all kinds of irregularities and defects in the surface of ceramic tiles, so it is not suitable for products with a rough surface or those with stone inclusions close to the surface [4]. Therefore, it is important to look for new engobes and methods of application which, on the one hand, help to protect the surface from atmospheric precipitation and destruction and, at the same time, are able to blend well with ceramic tiles and mask irregularities or surface defects.

The creation of a three-dimensional engobed surface on a brick is possible using several technological approaches that allow a variety of textures, reliefs and decorative effects. The main methods for creating a three-dimensional engobed surface are

1. The use of high-viscosity engobes (with a high content of solid particles) allows the creation of relief patterns that do not spread during drying and firing; this

method is suitable for imitating natural textures such as stone or wood.

2. Stamping or screen printing on raw engobe – before drying, stamps, rollers or screen printing can be used to create patterns and embossed textures; this method allows clear geometric or artistic ornamentation.

3. Spraying engobe using stencils – allows you to create multi-layered relief patterns, including spraying engobe at different angles to create a 3D texture effect.

4. The addition of granular or powdered components to the engobe body – quartz grains, chamotte or ceramic granules, glass beads, mica grains, etc. – creates a three-dimensional effect when fired; the larger the grain size, the more expressive the texture.

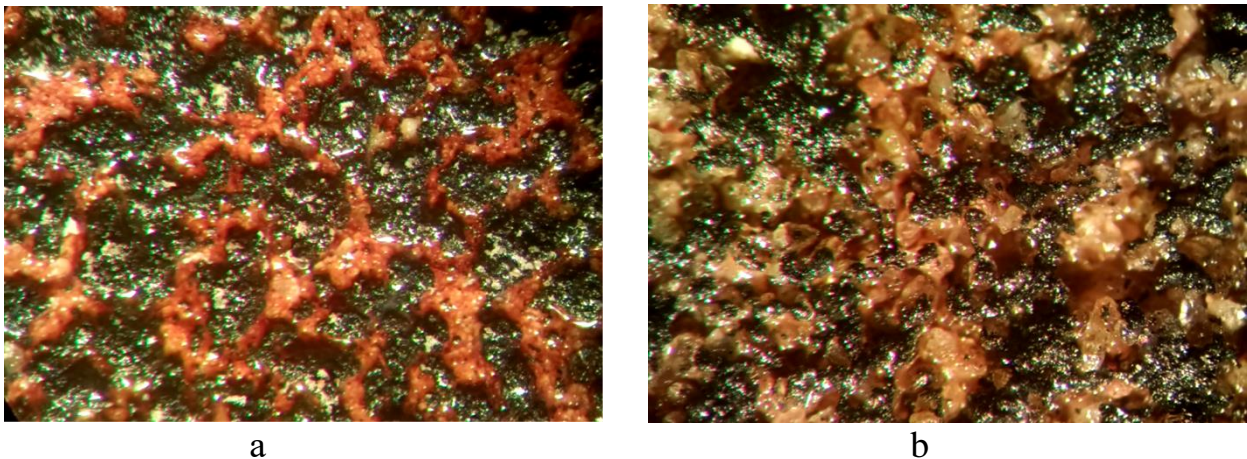
5. Combining engobe with glazes. The use of transparent or coloured glazes on embossed engobe creates additional visual effects, especially glossy and semi-matt transitions. It is possible to create a crackle effect (cracks in the glaze), which emphasises the relief of the surface.

6. The use of digital engobe printing - modern methods allow the application of three-dimensional engobe using 3D printing or digital inkjet printing, which opens up opportunities for complex designs and personalised architectural solutions.

7. Engraving on cured engobe – after applying a layer of engobe, laser or mechanical engraving can be used to create fine lines or three-dimensional patterns on the surface.

Of particular interest are complex decorating techniques that combine two or more coating processes. On the one hand, they are more difficult to implement in high-volume automated production. On the other hand, the uniqueness and exclusivity of the resulting products are advantageous.

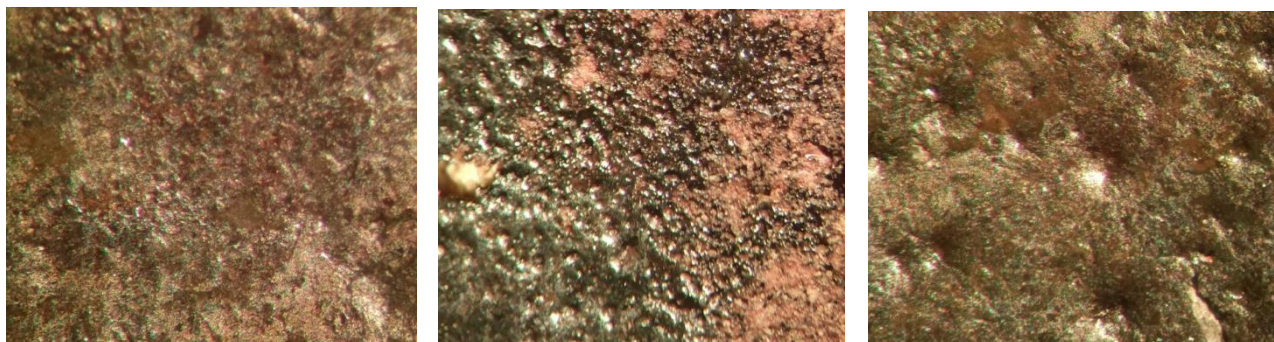
Fig. 1 shows examples of bricks decorated using a combination of wet and dry slip engobed.



**Fig. 1. Samples of decorated brick surfaces obtained by complex engobed**

The coatings in Figures 1a and 1b differ in the proportion of coloured engobe, leaner filler and vitreous component. However, if the application technique is not followed, either the surface relief is reduced (excessive glass content, too high firing temperature) and cracks appear due to the difference in the temperature coefficients of linear expansion of the coating and the ceramic body, or the coating becomes

loose, crumbles from the surface (excessive filler content). In all cases, both the decorative and protective functions of the coatings are reduced (Fig. 2).



**Fig. 2. Defects of the samples in case of violation of the conditions of complex engobing**

The three-dimensional engobed surface improves the decorative properties of building bricks, increases their resistance to weathering and can be used in architectural and landscape design. These technologies are actively developed in modern ceramic production, especially in the premium segment of building materials.

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