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Clay – Ecological Natural Binder

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Abstract

For the masonry mortars from the actual constructive solutions (confined masonry) a high strength is not required. The cement – lime mortars using in which composition artificial binders and natural sands are present are expensive and is including a high obtaining energy consume. The clay, residual rock, represents a mineral binder that can satisfy the imposed requirements for the mortars from the confined masonries. The clay resources are unlimited and can be found in the areas pour in natural construction materials. The presented study is analysing four clay sources from several Moldavian counties that can be used as binder in masonry. The mineralogical analysis, hardened clay's characteristics and especially the support adhesion are presented.

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Keywords: clay; mortar; binder; monmorillonit; adhesion.

1. Introduction

The clay was used from ancient times for building realization as mortar, for masonry ceramic bricks manufacturing, massive buildings cast in moulds etc. In time, the clay simple or in association with the construction lime was representing the main binder used for masonry realizing. [1,2]. The artificial binders development left the clay on the second plan. The actual constructive systems of the masonries impose structural elements that are leading to the confined masonries, where the using of the high strength mortars is not required [3]. In the Laboratory of the Building Materials Discipline from the Faculty of Civil Engineering and Building Services Iassy, studies were carried out regarding the clays binder character, as a contribution to the sustainable development, leading to the

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conclusion that the clays using as masonry or plastering binder satisfies its imposed requirements, representing for the builders a local, ecological, cheap and efficient material.

The presented material is the result of the testing, for several years on 42 clay sources from Moldavia, with the final recommendation for ceramic industry and as binder.

The name of clay comes from the Greek “glya”, meaning gluey, or adhesive, showing the mortars preparation as utilization field.

The clay represents a clastic or jellification unconsolidated sedimentary rock. It was formed on the line of quartz, feldspars (Ca, Na, K aluminisilicates), mica (hydrated Ca, Na, K aluminisilicates) clay (hydrated aluminosilicate).

Regarding the materials from the clay structure this if formed by tetrahedrons that are bond in cycles, and the bonding mode of the cycles in space is determining the formation of many minerals (caolinit, montmorillonite etc.).

Presentation: pelitic structure having fractions between 0.0002 and 0.002 mm: compact texture; color from white, grey, green, blue, red, brown, black; as associated minerals: silica, carbonates, iron oxides etc.

Technical characteristics: plastic, volumic mass between 1800 and 2000 kg/m3, high porosity, reduced or nule permeability, high water absorption ability, high ionic change ability.

The presence of the caolinit is recommended for ceramic industry and the presence of the montmorillonit for the building industry for mortars, impermeabilization layers, associated material for cereal wastes, etc.

2. Experimengtal program

The clay samples were natural dried in laboratory conditions, were milled in ball mills and sieved to obtain the dusty material used for the experimental program.

To be mentioned that the natural dried material can be fragmented (crushed) by compression as well, in metalic vessels with piston or in mortars.

For the clays used as binder the following technical characteristics are required:

Milling finess

The fragmented material was sieved through the sieve having the dimensions of 1 mm and then its granularity was determined [4].

Equilibrium humidity (for preserving in bags)

The sieved material through the 1 mm sieve was dried at constant mass and then was preserved in glass vessels on a laboratory table in two uniform layers until the constant mass for the humidity equilibrium was obtained.

The dusty material is not agglomerating at this humidity value [4].

Bulk volumic mass in aerated and pocket state

The bulk volumic mass in aerated and pocket state was determined on the material at equilibrium humidity in aerated and pocket state in volumetric vessels of 1000 cm^3 [5].

Plasticity

The plasticity was determined for a certain mixing water amount with the following requirements [4]:

- The paste has not to stick on the wet towel
- The paste applied in thick layers of 5 – 10 mm has not to crack during the tensile process.
- And so on

Drying shrinkage