Hydraulic plaster with the addition of ceramic dust.

IS IT:

- [X] *Product*
- [ ] *Technology*
- [ ] *Equipment*

APPLICABLE FOR:

- [ ] *Restoration*
- [X] *Rehabilitation*
- [ ] *New Construction*

APPLICABLE ON:

- [ ] *1. Foundations and underground structures*
- [ ] *2. Vertical structures*
- [ ] *3. Horizontal structures and vertical connections*
- [ ] *4. Roof and terraces*
- [ ] *5. Façade and building envelope*
- [X] *6. Finishes and completion elements*
- [ ] *7. Integrated services*
- [ ] *8. General strategies for building recovery*

Related companies: *No companies; traditional material.*

DESCRIPTION

Traditional plaster prepared with the addition of ceramic dust.

Hydraulic lime plasters are used during conservation of stone and adobe masonries especially in masonries with sedimentary rocks having low mechanical strength

WHY TO USE

These mortars have better qualities than lime plasters (more durable in water, quicker drying, etc.).

HOW TO USE AND APPLY

They are used on a stone masonry or adobe surface in two or more successive layers. As these are experimental materials more specific regulations about their use are not in force.

TECHNICAL CHARACTERISTICS

Examination of the physical and mechanical properties of the above-mentioned experimental plasters revealed some of the important factors which determine their strength, workability, and durability. The main parameters influencing these properties were:

(ι) the binding system (type, fineness, proportion of binder),

(ii) the water content (especially the water/binder ratio),

(iii) the aggregates (type, grain size, binder/ aggregate ratio),

(iv) the degree of compaction,

(v) the mixing process and

(vi) the curing periods.

The degree of fineness of the ceramic powder was found to be significant in determining its reaction with the calcium hydroxide in the plaster. It was found that the ceramic powder is active when its particle size is less than 150 microns. With a reduction of its size under 45 microns the powder becomes more active, and the compressive strength of the plasters exceeds 5 Mpa in 28 days and increases significantly over time. Experiments confirmed that the ideal ratio of binding / aggregate is 1:3. The addition of surplus water during preparation, as well as the absence of proper mixing and compaction, radically reduces the strength of the plasters.

RECOMMENDATIONS AND OTHER INFORMATION

The grain and fragment size of the crushed brick directly influences its hydraulic reactivity and, consequently, the physio-mechanical properties of crushed brick-lime mortars. The addition of surplus water in the mix reduced its strength radically. The flexural (Ft) and compressive (Fc) strengths of the samples generally showed the same trends, irrespective of age.

The porosities (P) of the experimental mortars were around 35%. This could be taken as an indication of a weak hydraulic to aerial character. The air-hardening lime mortar showed a slightly lower porosity value than most of the crushed brick-lime mortars, possibly owing to the presence of a dense carbonated rim on the surface of the sample which prevented moisture from reaching the interior of the mortar.

The experimental results confirmed the close relationship between compressive strength and porosity. Actually, compressive strength of the experimental crushed brick-lime samples increased with decreasing porosity.

The capillary absorption tests showed that the coefficient of water absorption (S) is dependent on the microstructural characteristics of the mortar and in particular, its porosity. Mortars with lower porosities and higher mechanical strengths (i.e. mortars with finer ceramic powder), generally showed lower capillary water absorption values, as would be expected from denser materials. The results also showed differences between the aerial and the weak hydraulic mortars. The latter exhibited lower capillary water absorption coefficients.
The evaluation of the physio-mechanical characteristics of the experimental mortars should be carried out bearing in mind their compatibility with old masonry. Low mechanical resistance (~ 5.5 MPa) and high porosity (35-40%) characterize one of the main building stones (i.e., the calcareous sandstone of the Nicosia-Athalassa formation) found on ancient monuments in Cyprus. The experimental mortars exhibit lower strengths than the

original stone and similar porosities. Therefore, one may assume that they are compatible with the units of historic buildings and can be used for re-pointing and re-rendering.

EXAMPLES

The case study of a vernacular dwelling in Kapedes. [See attached images at the end of this sheet].

REFERENCES / SOURCES AND LITERATURE

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Philokyprou, M., Maniatis, I., Charalambides, A., Xenophonots, C., Kyriakou, K. and Papadouris, G. 2003 "Analysis of Hydraulic Plasters from Cyprus and Replication Experiments" (poster presentation), 4th Symposium on Archaeometry of the Hellenic Society of Archaeometry, Athens, Greece, 28-31 May.

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WEBSITE OF THE COMPANY

N/A

IMAGES AND CAPTIONS

Fig.1-2: Application of hydraulic plaster on a rural dwelling in Kapedes. *©Maria Philokyprou*

Fig.3: An outline of the process of preparing the hydraulic plaster with the addition of ceramic dust. *©Maria Philokyprou*

Fig.4: Examination of its mechanical properties of hydraulic plasters. *©Maria Philokyprou*

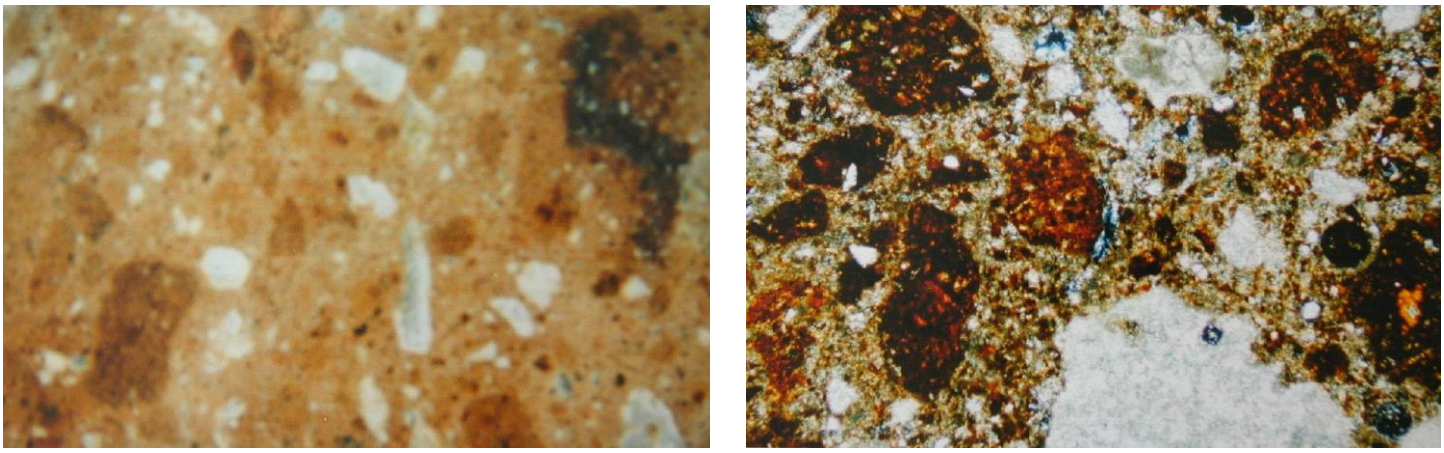

Fig.5-6: Hydraulic plaster under optical and polarized microscope showing the ceramic particles (spots in red).
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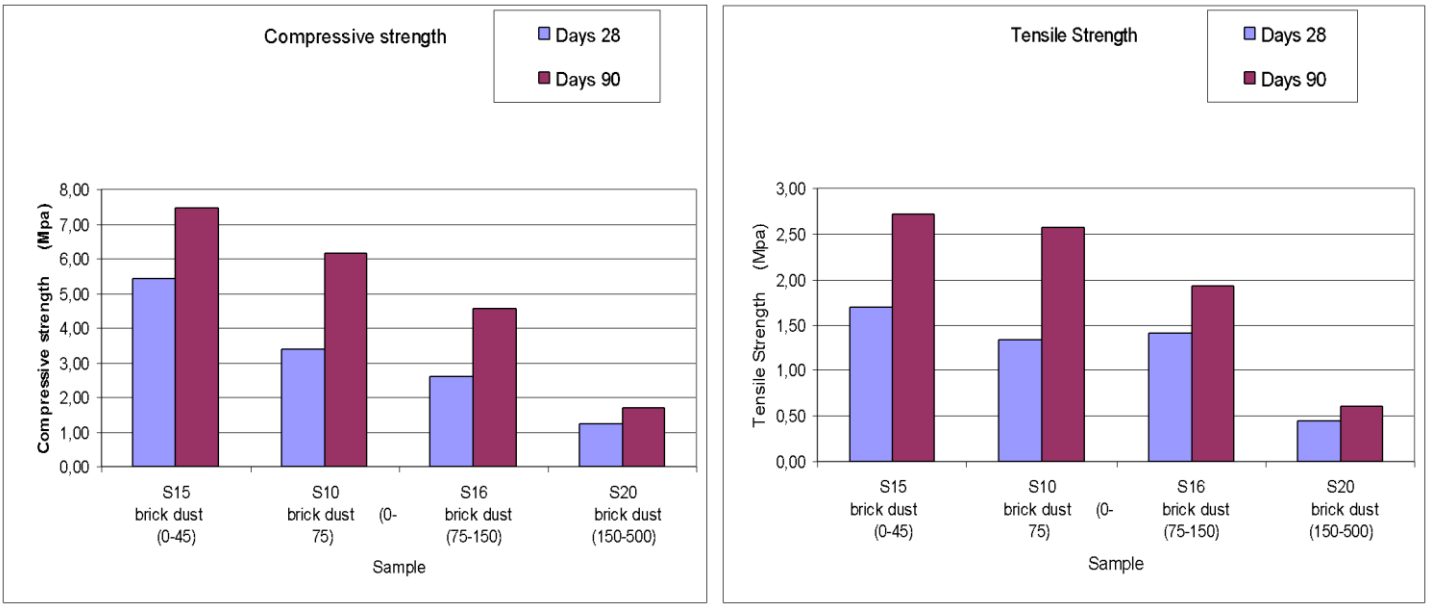

Fig.7-8: Diagrams showing the influence of the particle size of ceramic powder (brick dust) on the compressive and tensile strength. *©Philokyprou et al. (2003)*