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Honors thesis

COURSE OF DEGREE IN ARCHITECTURE

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Abstract

Raw earth architecture in Morocco: Experimentation of plaster for the protection of the walls

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by

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Keeping memory, protecting and handing on testimonials of raw earth architecture is a key element in order to safeguard the constructive culture of this material.

This goal can be achieved not only spreading knowledge related to this heritage, but also searching suitable techniques and materials to be used for the protection of degraded artifacts and for the construction of new buildings.

The research activity presented in this graduation thesis has the goal to test different types of raw earth plasters and to compare their features and performances, in terms of water resistance, with those of plasters commonly used in Morocco in the region of Marrakech-Tensift-El Haouz.

Six raw earth based blends with the addition of different additives (gypsum, lime) and straw have been tested. The chemical and mineralogical properties as well as the mechanical performances of the compounds have been measured in order to evaluate the behavior of each plaster.

Plaster	Composition	
	I layer	II layer
A	earth	earth
B	earth + lime 15%	earth + lime 15%
C	earth + gypsum 20%	earth + gypsum 20%
A1	earth + straw	earth + straw
B1	earth + lime 15% + straw	earth + lime 15% + straw
C1	earth + gypsum 20 % + straw	earth + gypsum 20 % + straw

Tab. 1 – Composition of the plasters experienced.

Fig. 1 – Type of specimens: size 25x25 cm and 5 x 4 cm on the wall; thick of specimens about 2 cm.

The tests were carried out in the Laboratory of Materials and Components Testing "Roberto Mattone", Department of Architecture and Design at Politecnico di Torino and in the laboratories ICVBC (Institute for Conservation and Promotion of Cultural Heritage), CNR, Sesto Fiorentino.

The analysis of the results highlights how all the plasters tested show a general improvement in their performance characteristics, considering the sample A, based on simple raw earth, as the reference to which comparing the contribution of the additives used.

The plasters with the addition of lime B and B1 are characterized by an increase of capillary absorption capacity and, on the contrary, by a reduction in the level of erodibility, as the levels of erosion of these plasters were zero.

Concerning the contribution given by the gypsum to the performance characteristics of the plaster C and C1 with respect of the eroding action exerted by the water, this is slightly less compared with that given by the lime. But it should be noted that the results of shear tests show that the best performances are obtained with the plaster C (raw hearth + gypsum), that detaching took away part of the support to which it was applied.

Whatever the additive used was, the best results against the aggressive action exerted by water were achieved by plaster containing straw. On the contrary, the worst results were obtained in the adhesion tests - Shear tests - where the addition of straw has led to decreased adhesion of the plasters to the wall substrate.

From the aesthetic point of view, the spectrophotometric measurements have established the chromatic differences between the different compounds, as a function of the additive used. In the plaster with lime yellowing occurs, while for those with the addition of gypsum whitening is observed. The presence of straw causes an increase in the chromatic variations in plasters with lime as well as in those with the addition of gypsum.

Summarizing, it can be said that the gypsum is the additive that mainly improves the performances of the plasters. The behavior of the compounds of plasters “in situ” remains to be determined, compared to the results obtained in the laboratory, in order to assess the real behavior when plasters are applied on large surfaces and directly exposed to the aggressive action of external agents.

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