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Laboratory verification of water vapour permeability of plaster compositions

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Abstract

There are many significant historic buildings of our national heritage in the Czech Republic that worth protecting. These astonishing buildings are most frequently damaged by water, precisely speaking by moisture. The moisture can come from several sources, for example from a flood. That is the reason we should know about the materials and their behaviour from the point of view of the moisture in the vapour form as much as possible. This paper summarizes properties important for material water vapour permeability represented by water vapour resistance factor. There are stated and tested three compositions of materials, commonly used in the praxis, in the paper. The compositions are: basic adhesive diffusion mortar with no finishing; basic adhesive diffusion mortar + silica penetration; basic adhesive diffusion mortar + silica penetration + silicate plaster. Not only diffusion parameters but also the border condition and their impact on the material behaviour have been tested and determined. We should know how to treat these buildings during a flood well. After previous floods that damaged many valuable buildings it seems to be a very priceless familiarity. Moreover the tested values help to find out if there is going to be condensation of water vapour on the surface of the tested material inside a building.

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Keywords: Diffusion; water vapour resistance factor; border conditions; temperature; relative humidity, barometric air pressure; mortar; water vapour permeability; plaster; moisture

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1. Introduction

The Klokner Institute is a research institute that, beside other things, has been dealing with tests of diffusion properties of various building materials, because these properties are ones of the basic characteristics of building materials. The characteristics help in instance when drying of buildings after floods in case of selecting a way of a building rehabilitation. This paper compares three compositions of building materials. These compositions are often used in praxis. The materials differ from each other mainly in their diffusion parameters. The mentioned compositions are: basic adhesive diffusion mortar without finishing; composition with extra penetration; and composition with extra penetration and silicate plaster. Nevertheless it is necessary to deal not only with the values themselves, but the impact of the standard used for the calculation should be also taken into consideration.

2. Material and methods

The experiments of many compositions of building materials have been performed in the accredited laboratory of the Klokner Institute, CTU in Prague. Three chosen compositions commonly used in the praxis were used for a comparison. The compositions were intentionally chosen this way to have rather different diffusion properties and be able to demonstrate an influence of border conditions on diffusion different compositions. Relative humidity, temperature and barometric air pressure belong among the examined border conditions having the influence on the value of water vapour resistance factor and other diffusion properties. Also the standard, according to the value is calculated, is equally important for the value of water vapour resistance factor.

The following compositions were tested:

- Composition 1 (LSHD): Basic adhesive diffusion mortar with no finishing
- Composition 2 (LSHD + PS): Basic adhesive diffusion mortar + silica penetration
- Composition 3 (LSHD + PS + SZO3): Basic adhesive diffusion mortar + silica penetration + silicate plaster with maximal grain 3 mm

The required diameter of the discs is stated in the both standards [1,2]. So the discs were made according them. Then three approximately 117 mm diameter discs from each composition were tested. Also the measuring was performed according to the standard ČSN EN ISO 7783 [1,2] focused on paints and varnishes as well as the determination of their water vapour permeability. Basic properties of the tested compositions (weight, thickness and their average values) are stated in the following tables (Tab. 1 – 3).

These mentioned properties were determined before the tests of diffusion properties. Sample diameters should range around required value 117 mm, imprecisions were solved by silicon sealant. It has two roles. First is to ensure an impermeability of water vapours around a sample, second is to enable permeability only through a tested sample. Sample thickness is taken into consideration in the calculation of the diffusion properties themselves.

Table 1. Composition 1 - Dimensions.

Sample mark	Sample number	Sample weight (*g*)	Ø (*mm*)		Average (*mm*)	Sample thickness (*mm*)		Average (*mm*)
LSHD	A	30.7	117.3	118.0	117.7	1.8	2.0	1.9
	B	30.9	117.7	117.7	117.7	1.9	1.9	1.9
	C	34.2	117.2	117.6	117.4	2.4	2.3	2.4

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