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METHODOLOGY FOR DETERMINATION OF MOISTURE DISTRIBUTION

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Abstract: *The aim of the research is to determine the capillary conductivity coefficient as a characteristic material moisture parameter of the building materials using a non-destructive method - microwave radiation. A test specimen of ceramic is subjected to an isothermal moisture intake process. The transient moisture distribution in the specimen during the process is determined, at different stages of the process, using EMW-ray equipment. Boltzmann transformation of the experimental data results in a single moisture distribution curve, characteristic of the specimen.*

Keywords: ***moisture, capillary conductivity, diffusion, water flow, EMWR microwave radiation***

1. Introduction

Moisture in liquid or gaseous form can penetrate into porous material of structures. To express the negative effects of moisture on building materials or building structures more accurately, it is needed to use the most accurate method of detecting moisture diffusion.

2. Transfer of the moisture

As a quantity characteristic to define moisture transfer within materials consists from capillary porous matters is used the coefficient of capillary conductivity. It is characteristic parameter (by humidity gradient) for transfer of liquid moisture within porous substance. All methods explaining the coefficient of moisture conductivity use the one-dimensional diffusion equation. To obtain characteristic curves of capillary conductivity coefficient, there is used the following Lykov formula covering the consistency of moisture flow and continuity formula (Mrlik 1986; Kutilek 1992):

$$\frac{\partial u}{\partial t} = \frac{\partial}{\partial x}\left(\kappa \frac{\partial u}{\partial x}\right) \qquad \rho_S \frac{\partial u}{\partial t} = -\frac{\partial q}{\partial x} \qquad q = -\rho_S \kappa \frac{du}{dx} \tag{1}$$

3. Procedure deliquescence curves assessment

a) Dependence between EMW radiation and content of moisture in material from regression formula

u_m = -1,342033167.10-7 .z^3 + 0,0001936510773 .z^2 - 0,1038753765 .z + 20,78641097

b) Dependence between change of EMWR and moisture into distance from source of dampness,

c) Characteristic curves defined by the Maple software, Fig. 2.

$u_{m,t} = f(z_t(x))$, z *is* EMWR intensity which come through specimen; x is position of moisture; t is time interval of measurement and u_m is moisture by weight

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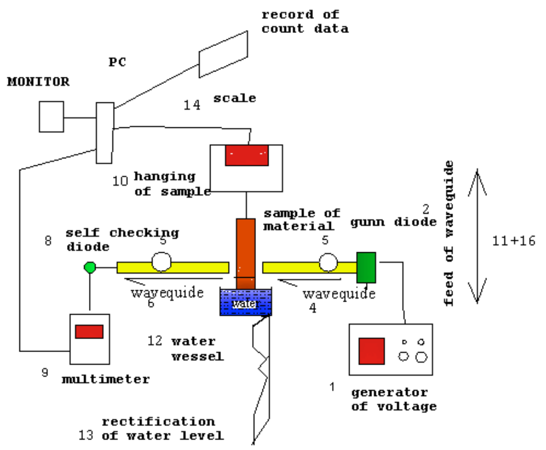

Fig. 1 Scheme of measurement apparatus (Skramlik 2009)

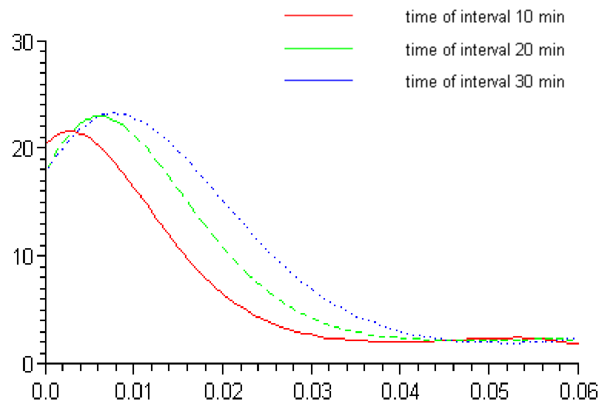

Fig. 2 Deliquescence curves (Skramlik 2009)

4. Experimentally assembler apparatus

On the basis of the patens has been by the institute (US) measurement apparatus (experimentally assembled) see Fig. 1.

5. Conclusions

Diffusion of moisture in porous material is currently adequately addressed. The problem remains the condensation of water vapor inside of the porous structures, for which there is no practical basis. In comparison with the destructive method, this methodology of calculating the capillary conductivity coefficient provides more data and more accurate information of the moisture content in detailed sections. The advantage is the relatively fast obtaining of the measurement results and the possibility of continuous measurement of more moisture curves on one sample of the material in any time interval without interrupting the measurement and handling the sample.

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