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Objekttyp: **Article**

Zeitschrift: **IABSE reports = Rapports AIPC = IVBH Berichte**

Band (Jahr): **77 (1998)**

Persistenter Link: https://doi.org/10.5169/seals-58260

Injection Methods for Retrofitting of Moisture Damaged Constructions

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Summary

For the reconstruction of buildings damaged through rising moisture exist a great variety of methods. These methods based on mechanical, electrical, physical an chemical effects. Whether these effects generate a sufficient drying effect depends on certain factors, like moisture content, conditions of evaporation, zeta-potential and so on. Before using these methods it is necessary to determine by diagnostic analysis which method can be apply. Another possibility to increase the safety of success of reconstruction is the improvement of the effectiveness of the methods. By this way injection methods can be used for building materials with high moisture content, while a warming up - and drying process forces the penetration of the injection material in the construction.

Keywords :reconstruction, retrofitting, damage due to humidity, injection, warming up process, paraffin, wax

1. Introduction

Moisture is the main reason for deterioration of stones, bricks, constructions and buildings. It penetrates into the pores and causes by several processes. That is why when attempting to preserve damaged and endangered buildings one tries to influence the moisture balance in a way that reduces the moisture contents in building materials. An effective method to maintain construction is the using of pore-sealing materials, which have to fulfil the requirements:

1. The pore must be sealed completely and with high reliability.
2. The spreading of the medium inside the building material must be determinable and controllable.
3. The medium should be compatible with the building material and should not cause any secondary effects.
4. The environmental compatibility should be very high.

Paraffin is a medium fulfilling these demands to a high degree. It is compatible with the building materials and the environment. After a warming up process it can penetrate deeply in the construction and fill the pores of building materials completely.

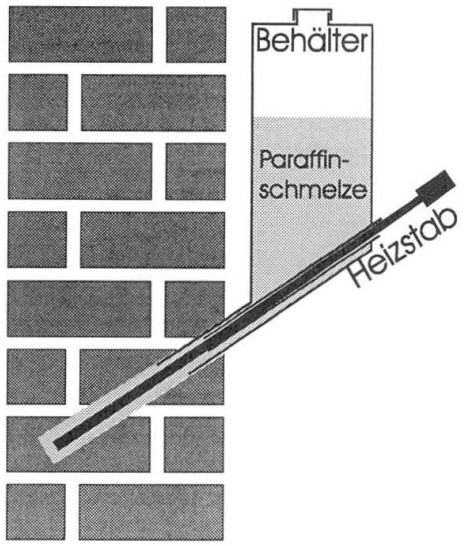

Fig. 1: Device for paraffin injection

2. Thermally Stimulated Injection of Paraffin to Build up Subsequent Moisture Barriers inside the Wall

Liquid paraffin is able to penetrate by means of capillary forces or pressure support. Therefore the treated wall has to be warmed up to a temperature above the melting-point of paraffin before, or while, the treatment takes place. Through this heating is process the moisture vaporises and the moisture-damaged masonry becomes dry. Paraffin injection is practised in the following way: heating sticks are introduced into the bore holes and after a sufficient drying and warming the paraffin filled in. Fig. 1 represents a injection methods using a heating stick inside the bore hole, which one is continuously surrounded by liquid paraffin.

3. Increasing the Durability of Porous Stones by Paraffin Impragnation

A large number of damaging processes are produced by water entering in the pores and causing several damaging reactions. By a Paraffin treatment the constructions are drying and a moisture barrier is produced. Fig. 2 shows a result of a paraffin injection in a moisture damaged wall.

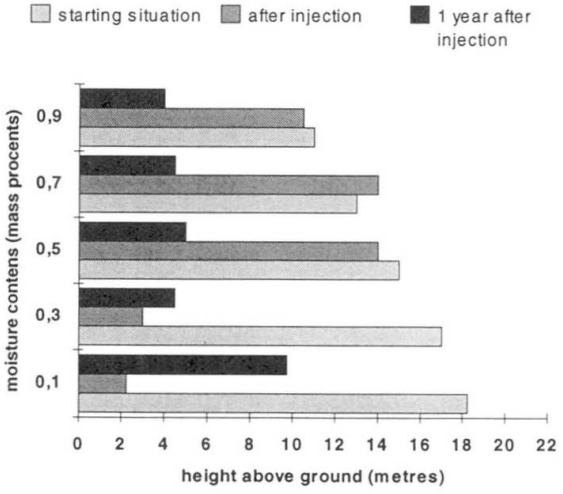

Fig.2: Moisture distribution inside a wall before and after a paraffin injection

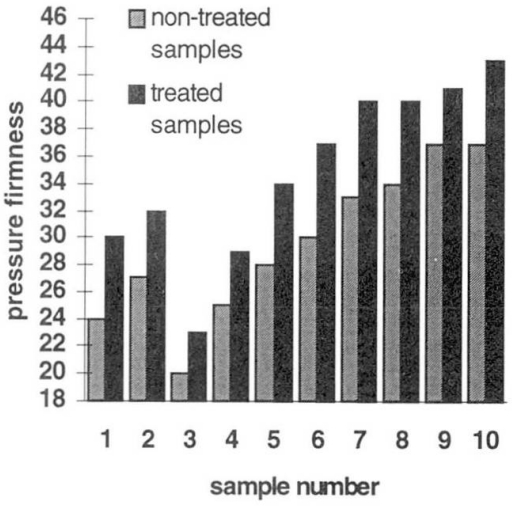

Fig. 3: Increase of compression strength

Filling the pores with paraffin also changes the mechanical properties of the treated building material. Fig. 3 demonstrates the increasing of pressure firmness of bricks by paraffin impregnation. The paraffin's ability to penetrate depends only on the temperature, therefore long treatment times are technically possible and in principle uncomplicated. Through this it is possible to determine the spreading zones of paraffin penetration and adapt them to the requirements of moisture- and stone protection.