PERFORMANCE EVALUATION OF VARIOUS FINISHING LAYERS FOR AEROGEL PLASTER

Samira Aien, Mahnameh Taheri, Ardeshir Mahdavi

E259.3 - Department of Building Physics and Building Ecology, TU Wien

INTRODUCTION

In recent years, many efforts have been undertaken to investigate potential energy-efficient renovation solutions for existing buildings, especially in case of historical buildings. Applying thermal insulation systems to exterior building envelope is one of the most common strategies to reduce building energy use. In this regard, using new insulating nano-material with special hygro-thermal properties, such as Aerogel, has become increasingly common worldwide. This paper describes the result of a case study on application of various finishing layers on Aerogel plaster, which were applied on the external layer of a retrofitted construction.

Silica Aerogel is an open-cell nano-material that is suitable for applications where particularly high thermal insulation properties are desired[1]. An insulation coating based on silica Aerogel has a minimal impact on the thickness of the walls, and is a lightweight refurbishment system with high thermal performance (low thermal conductivity, i.e. 0.014 W.m-1K-1, and low density, about 3 kg.m-3)[2]. In addition to the thermal performance, the hydrophobic behavior of an Aerogel based material is useful in building renovation. Applying the rendering on the external surfaces reduces or eliminates the undesirable consequences of condensation and moisture problems within the wall structure[3].

METHODOLOGY

The case study in this paper is an office area in the historical building of TU Wien, Vienna, Austria. The old wall construction of the case study (with three layers, including gypsum plaster, hollow brick masonry, and lime cement plaster) was retrofitted by applying a plaster system encompassing a highly-insulated Aerogel layer (Fixit 222)[4] on the existing construction (Figure1). Four different combinations of exterior plaster Röfix together with Röfix PE [4] colour coating were applied on the aerogel layer, to harden the surface and give it a better grip (Table 1, field S1 to S4).

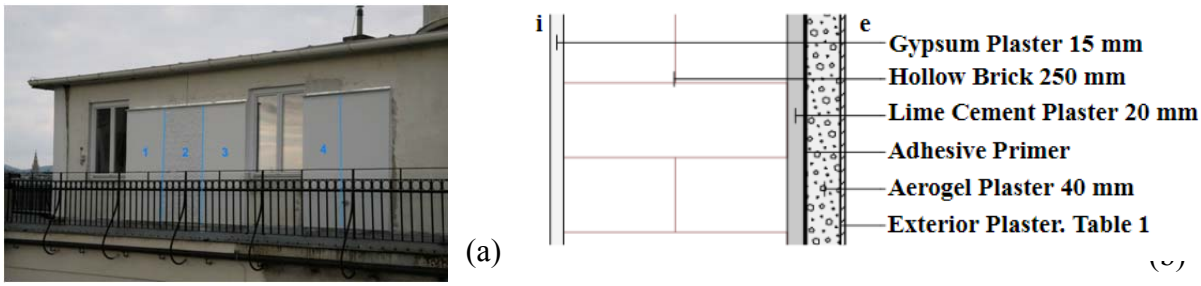

Figure1: Tested Façade with the marked locations of fields 1 to 4 (a), and a section of the layers (b)

To study the hygro-thermal performance of the wall, as influenced by different choices of the abovementioned fields, a set of sensors were installed within different layers of the construction. This enabled the in-situ measurement of temperature and relative humidity within the layers. This study utilizes the monitored data from the winter period 2013/2014.

Table 1: Combinations of exterior plaster of fields S1 to S4

Field	Plaster	Silicate paint	Sd-Value (m)	μ - Value	Remarks
S1	Röfix 380 fine grained	Röfix PE 819 Sesco, lime wash	0.0002	12-15	Diffusion open, stores moisture
S2	Röfix 750 coarse grained	Röfix PE 225 Reno, silicate paint	0.01	20	Diffusion open
S3	Röfix 380 fine grained	Röfix PE 819 Sesco, lime wash	0.0002	12-15	Diffusion open, stores moisture
S4	Röfix 380 fine grained	Röfix PE 419 Etics, silicon resin paint	0.1	12-15	Diffusion open, water repellent

RESULTS AND CONCLUSION

In order to investigate the humidity level and condensation risk, specific humidity values were studied. The boxplot in Figure 2 illustrates the specific humidity distributions in different layers, showing the minimum, maximum, mean and range of the data in different fields. The results presented here illustrate that the specific humidity values in different layers are not significantly affected by the choice of different exterior plasters. In fact, other features of this layer, such as the appearance (i.e. fine versus coarse grains), are more relevant for the selection of one field over the other options.

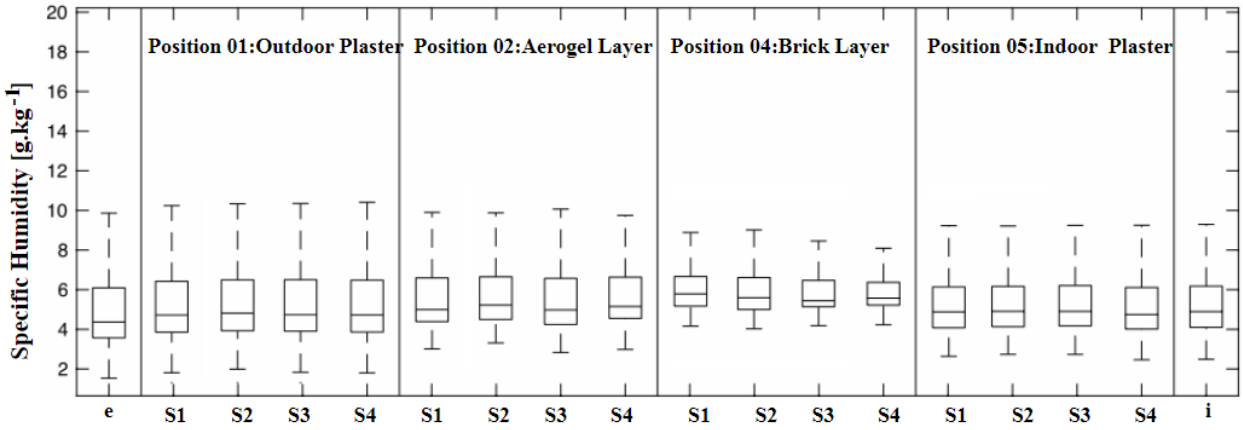

Figure 2: Specific humidity of fields S1 to S4 in different position of the construction in winter 2013-2014

REFERENCE

[1] K. Nocentini, P. Achard, and P. Biwole, “Hygro-thermal properties of silica aerogel blankets dried using microwave heating for building thermal insulation,” Energy Build., vol. 158, pp. 14–22, 2018.

[2] F. Pacheco Torgal,C. Buratti,S. Kalaiselvam,C.Göran Granqvist, Nano Biotech Based Mater Energy Building Efficiency, pp. 17–40,2016

[3] M. Ibrahim, E. Wurtz, P. H. Biwole, P. Achard, and H. Sallee, “Hygrothermal performance of exterior walls covered with aerogel-based insulating rendering,” Energy Build., vol. 84, pp. 241–251, 2014.

[4] Fixit group, http://www.fixit.ch/Home/Produkte/Restaurierungs-und-Sanierungsprodukte/. Last accessed on 02.27.2018.