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Short Report on IBP-Report RK 022/2013/294e

Application of an internal wall insulation construction with vacuum insulation panels for the building stock using adhesive matting

Research on application
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Content

1 Starting position

The use of internal wall insulation with vacuum insulation panels (VIP) provides a way for energetic building stock refurbishments, where special consideration to the external appearance of a building has to be taken into account and thin insulation thicknesses is required. The installation of VIP internal wall insulation in building stock often faces design problems and issues of removal and reversibility. Conventionally, fully adhered assemblies could not be dismantled without damage to the original surface.

2 Purpose of the project

The general aim of the project is the innovative application of an exemplary wall construction with vacuum insulation panels (VIPs) in combination with adhesive matting in the field of internal wall insulation of the building stock. New solutions and approaches should be developed and demonstrated by the investigations. In conjunction with an adhesive mat as a separating layer, it is possible to design the internal wall insulation removable or reversible, as an important aspect of the reversibility for renovation and repair work in old buildings and historic preservation areas. The mats are pinned with only a few dowels to the wall. The adhesive mats are made of thin mesh with single-lined fleece. The fleece protects the original surface from the adhesive mortar used for fixing the VIPs to the wall, and thus enables a largely reversible attachment. Similarly, these mats enable a better adaptation of the dowel position given on the ground, which offers the possibility of placement in voids and thus help to protect valuable wall areas, e.g. with decorative historic paintings, and therefore can be beneficial for conservation reasons.

In this project, a combination of measurements in a case object building and computational simulation is performed , which serve to check a prototype wall construction for the economic and safe use of VIPs for existing buildings. In addition, a possible change of condition of the masonry surface will be examined and the measured data will be processed.

In a first step different adhesive matt systems that are available on the market, have been looked for and one of them is selected for use. Prior to installation, the construction was checked by calculation with the hygrothermal building simulation software WUFI® developed by Fraunhofer IBP. The experiments took place in a building at the test site of the Fraunhofer IBP Holzkirchen. Here suitable test buildings, laboratories and workshops for the implementation of the project exist (Fig. 1), and also the required climate data for the site is known.

Figure 1:
Ansicht_Messraum.jpg
Interior view of the experimental building with the east and south walls with color swatches and some already mounted adhesive mat.

Within not sufficiently over the entire surface adhered fixed internal insulation systems backside air flow from infiltrated indoor air may appear which can lead to mold growth. For specific measurements of backside air flow, the application of adhesive mat is suitable, since a defined layer of air is present in the mesh (Fig. 1 and 4). To achieve a higher level of security against backside air flow in the adhesive mat was formed with special seal joint dividing the masonry in several sectors. To assess the impact of the seal joint on the original wall surface different sealing methods were developed. Four different systems were therefrom selected and applied. In addition, some specific open joints were produced in subfields as a reference for not tight seals. The surface of the wall was painted with defined colors in different historical binders (Fig. 1 and 2) to assess changes in consequence of the insulation. The color values were measured prior to mounting using a standard method (Fig. 3). After removing the interior insulation, a further check on the original wall was made in order to assess the surface concerning degree of damage-freeness and change of the color values.

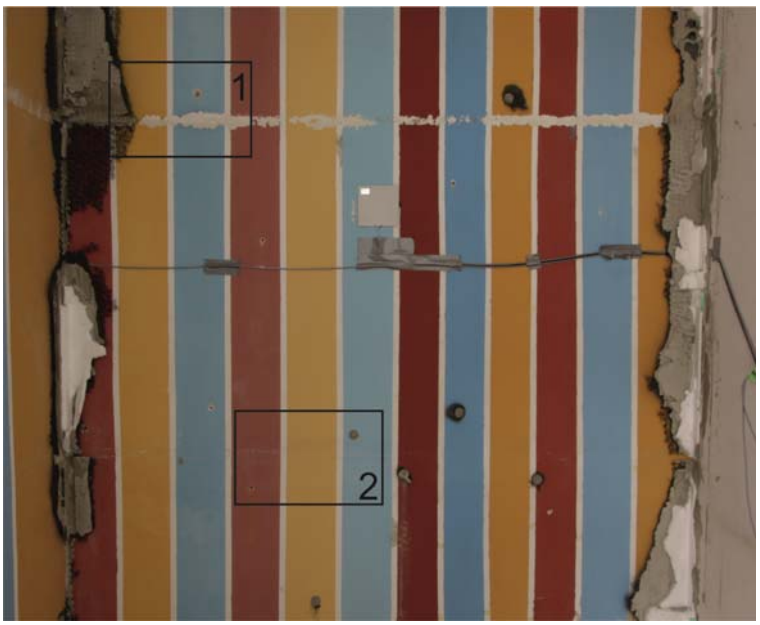

Figure 2:
Wand-Süd_nachher.jpg
South wall after removal of the interior insulation.

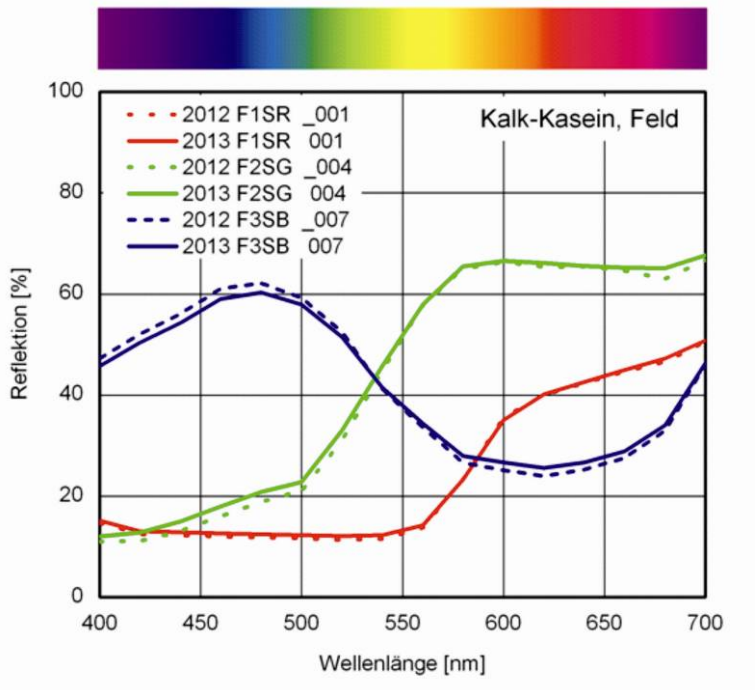

Figure 3:
Farbmessung_Kalk-Kasein.jpg
Color reflection on the binder system lime-casein on the south wall with the colors red, yellow and blue before and after application of interior insulation.

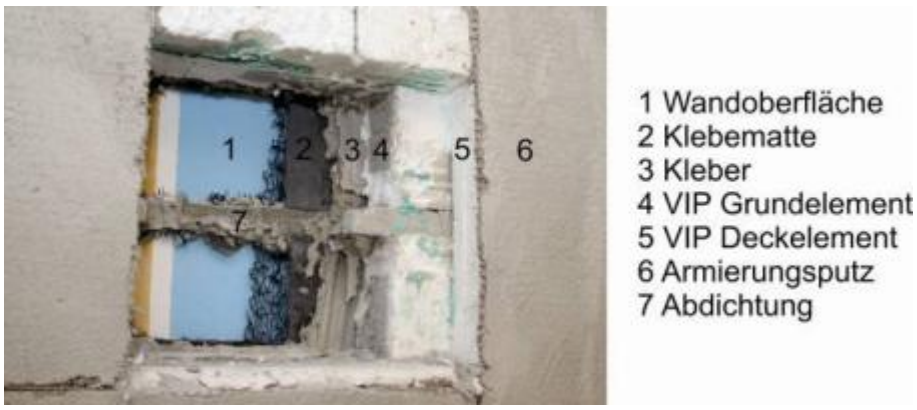

Figure 4:
Innendämmaufbau_VIP.jpg
Component opening with layer indication of the interior insulation at the east wall.

To assess the effect of the internal insulation monitoring measurements were made with temperature sensors, relative humidity sensors and heat flow meters at the boundary layer and additionally with an infrared camera (Fig. 5). In addition, a combination of measurement and calculation is used for checking the developed component structure. The further computational studies were carried out on the basis of the measured data respectively using the data as boundary conditions. In the simulation the backside air flow were taken into account and their impact calculated on moisture balance (Fig. 6) and predicted mold growth.

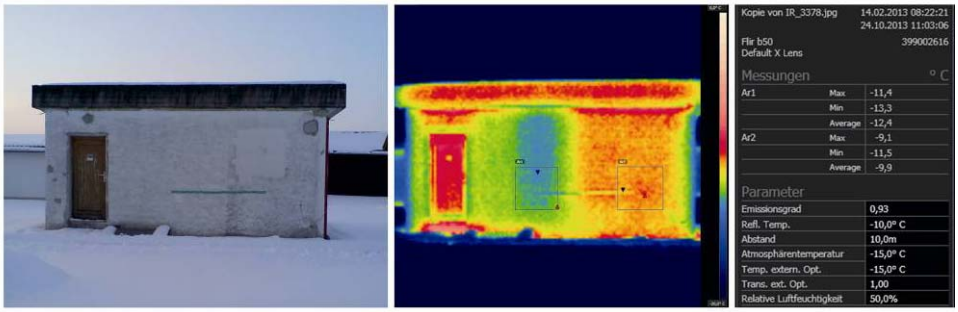

Figure 5:
Aussen_Nord_2013-02-14_IR-Bild.jpg
Exterior view of the north side of the test building with IR image.

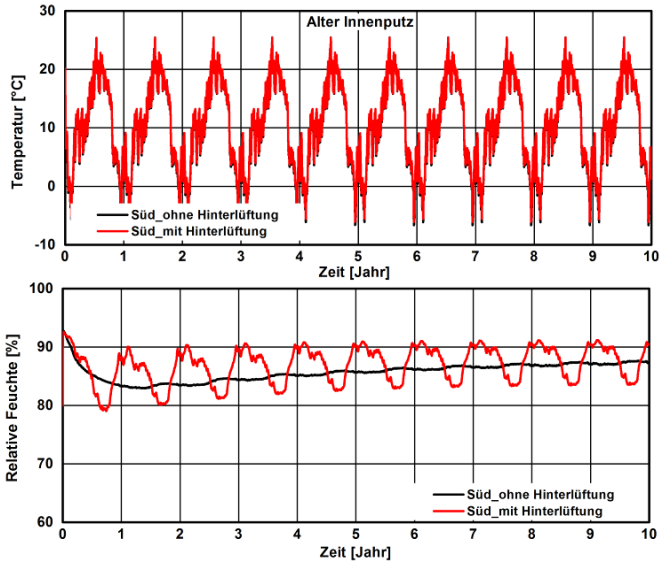

Figure 6:
Temperature and humidity in the interstitial layer between original plaster and new applied adhesive mat calculated with tight and leaky construction on a south oriented facade over a time span of ten years.

3 Conclusion

The investigations for removable assembly contribute to a significant development of reversible internal wall insulation. It was possible to dismantle the VIP largely non-destructive to the orginal surface. The results in terms of the conservation status of the colored surfaces and changes of the colors are encouraging. The mold growth by backside air flow could not be resolved despite the effort for sealing. With simulation the effect of the background current was reproduced and the long-term performance was calculated. From the perspective of conservation of historic surfaces the separation with lamination of the original surface from the cement adhesive is a promising option for internal insulation.

4 Key data

Short Title:
Vacuum insulation paneling with adhesive mat for building stock
Project Leader:
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