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Field Study on Hydrophobised Internally Insulated Masonry Walls

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1 Introduction

Driven by energy concerns and stricter energy regulations, wall insulation gains increasing importance. When dealing with renovation projects, three post-insulation techniques make a thermal upgrade of existing walls possible, i.e. cavity wall insulation, exterior insulation or interior insulation. For massive masonry walls with a valuable exterior facade, however, interior insulation remains as the only option. Unfortunately, interior insulation often leads to higher moisture contents in the wall, increasing the risk on wood rot of embedded wooden beam ends, frost damage, etc. (Vereecken *et al.*, 2015). These damage patterns are to a large extent caused by an exterior moisture source such as wind-driven rain (WDR), and therefore the application of a hydrophobic treatment is often pushed forward. To correctly estimate the effectiveness and potential side effects of a hydrophobic treatment, however, more insight on the moisture transport in hydrophobised walls is required. Thereto, a field study on the hygrothermal performance of hydrophobised masonry walls is presented.

2 Field Test Setup

Six south-west oriented masonry test walls were constructed at the VLIET test building of KU Leuven (Figure 1). Three of the six test walls were hydrophobised. The rain load on the test setup was measured via two wall-mounted WDR gauges. On the inside, two test walls were provided with a vapour tight XPS interior insulation system, while two other test walls had a capillary active calcium silicate (CaSi) interior insulation system. The remaining two test walls had no interior insulation system, and thus acted as reference walls. In each of the walls, two wooden beam ends were embedded in the masonry. To study the hygric performance, apart from traditional RH sensors, moisture pins were embedded in the walls.

Figure 1. (a) Outside view of the field test setup, (b) inside view of the test walls.

3 Results

Figure 2 shows (a) the electrical resistance as measured by the moisture pins at 5 cm from the outer surface and (b) the RH deeper in the wall, and this for the middle (1D) part of the walls. When applying the hydrophobisation, for the hydrophobised walls an abrupt drop in electrical resistance (and thus increase in moisture level) is shown near the outer surface. For the three hydrophobised walls, the inward redistribution indicated by the moisture pins is confirmed by the relative humidity (RH-)sensor at Position 5. In December 2018 and October 2019 (yellow and green rectangle), a strong decrease in electrical resistance for the three non-hydrophobised walls is observed. This can be attributed to wind-driven rain. The electrical resistance in the hydrophobised walls remains substantially the same. The impact of interior insulation is visible in the RH at Position 5. In spring and summer, a decrease in RH is observed, which is fastest for the hydrophobised non-insulated wall, followed by the hydrophobised wall with CaSi and the non-hydrophobised non-insulated wall. Next, the RH in the hydrophobised wall with XPS starts decreasing, but occurs slower than found for the non-hydrophobised wall with CaSi.

a)

b)

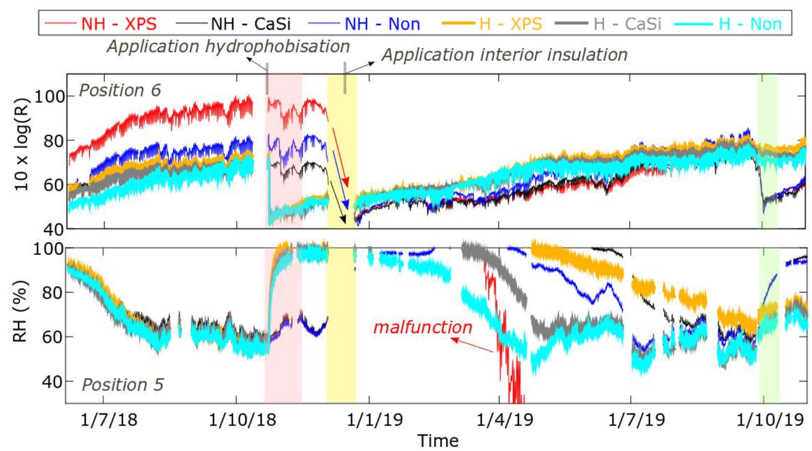

Figure 2. (a) Electrical resistance at 5 cm from the outer surface, (b) RH deeper in the wall, both in the 1D-part.

4 Conclusions

An increase in moisture level during the hydrophobisation process was measured. A drying period was needed to again reduce the moisture content near the outer surface. After this, hydrophobisation had a positive impact on the wall's hygric performance. Near the wooden beams, the highest RH was found for the non-hydrophobised wall with vapour tight insulation.

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