Fraunhofer Institut Bauphysik

IBP-Report 478

33 (2006) New research results in brief

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Prevention of algae and mould growth on facades by coatings with lowered long-wave emission

Introduction

In recent times more and more complaints about microbial growth on façades have been made [1, 2]. This growth occurs mostly in the first years after completion which leads to the displeasure of the building owner. A promising way to decrease the condensation on ETICS may be the application of Infrared-active paintings. The effect of such a paint has been investigated by hygrothermal calculations and measurements in field tests.

Test Results

Suitable temperature and humidity conditions at the outer surface of walls are necessary for biological growth. Beneath wetting by driving rain, condensation occurs in consequence of long wave radiation in clear nights by reaching temperatures below the dew point of the air. The importance of this wetting mechanism is obvious with regard to the occurrence of microorganisms mostly on the northern sides of buildings with no driving rain. Therefore the periods of surface condensation and the accumulated degree of cooling below dew point temperature are taken as criterion to classify the results [3].

To get the influence of irradiative properties of the surface calculations have been conducted with a dark colour of the rendering instead of a white one (absorption coefficient of 0.6 instead of 0.4) and with a lowered infrared emissivity (long wave radiation coefficient of 0.6 instead of 0.9).

Fig. 1 shows the accumulated duration of condensation. It is evident that a dark colour only causes a slight improvement. The good performance for ETICS with infrared active colour demonstrates that this is a promising possibility to reduce the risk of algal growth on ETICS.

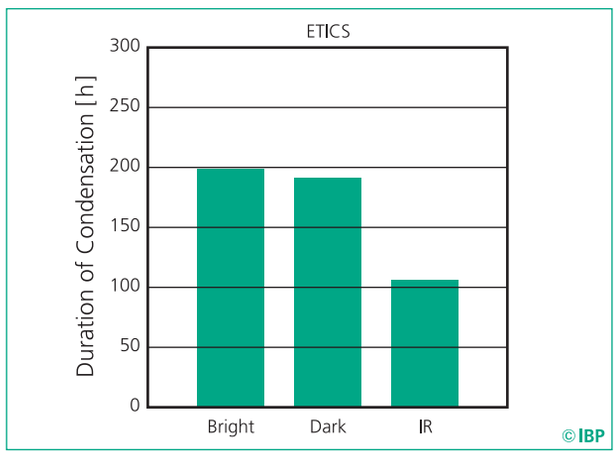

Fig. 1: Accumulated duration of condensation for walls with ETICS within the main growth period autumn in dependence on different surface properties.

For the field test beneath the outer surface of the walls the course of temperature has been measured to get the duration and the intensity of the condensation by comparing this surface temperature with the measured outdoor dew point temperature. The condensation times for the described ETICS and monolithic constructions are shown in fig. 2. Compared to the standard ETICS the monolithic constructions show very low duration of condensation despite their lower U-Value (0,22 instead of 0,35 W/m²K). The colouring of the ETICS brings a slight improvement.

The IR-paint, which was available for these tests, reaches a long wave emissivity of 0.78 instead of 0.6, as assumed for the computational investigations. Therefore the difference to the standard colour is less. With this IR-paint more than 20 % fewer hours of condensation have been reached, which corresponds well to performed calculations.

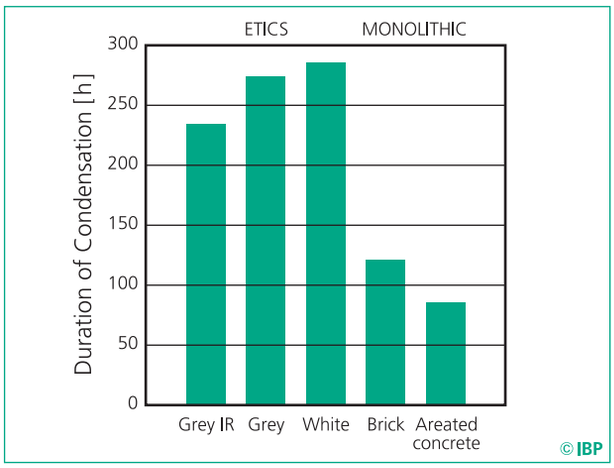

Fig. 2: Accumulated duration of condensation for the different wall constructions and paints.

Not only the duration of condensation and the amount of condensate is important to assess the risk of microbial growth, because for the microorganisms only the water on top of the surface of the façade is disposable. Therefore on a western façade the course of this amount of water has been measured, too. For this dry paper towels were pressed on the different surfaces and the amount of water was determined by weighing.

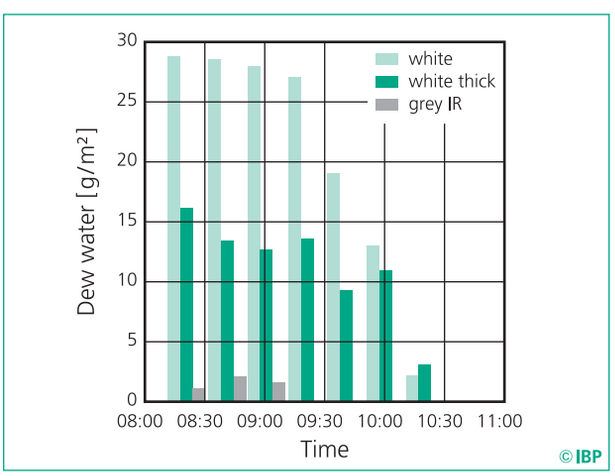

Fig. 3: Courses of surface water for west facing walls with different ETICS.

In figure 3 the results for a morning after a clear night is shown. On the surface of the standard ETICS with a white colour nearly twice as much water has been obtained as on top of the thick rendering. It is important to take into account that this results are strongly depending on the hygric material properties of the rendering and paint, too. With the thick rendering more of the condensate is absorbed below the surface. The most impressive result comes from the surface with IR-paint. This morning nearly no water could be measured on top of the surface.

Conclusion

To asses the risk of microbial growth the amount of condensation on the surfaces due to long wave irradiation, is a good criterion because most microbial growth can be found on northern oriented facades. In direct comparison of the monolithic walls made of aerated concrete or brick to walls with ETICS the advantages of monolithic walls is remarkable. But for the energetic improvement of existing buildings in most cases only the use of ETICS is applicable. Therefore solutions against microbial growth have to be found for these systems, too. For this computational investigations and measurements on the outdoor test site have been conducted. It can be shown that the choice of a darker colour brings only a slight improvement, because of the lack of thermal capacity of the standard rendering. With renderings of higher thickness the amount of condensate is reduced a bit more, but the most advantage of this system lies in the capability of absorbing part of the condensate below its surface. The most effective method instead is the use of IR-paints, which reduce the physical effect responsible for microbial growth.

Unfortunately up to now these paints are not stable enough for long-term weathering. But the results shown in this paper demonstrate, that these IR-paints are worth to do the necessary developments to improve their weathering resistance.

References

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Herstellung und Druck: IRB Mediendienstleistungen des Fraunhofer-Informationszentrums Raum und Bau IRB, Stuttgart