CERIS Civil Engineering Research and Innovation for Sustainability

BI-THEM – Design and development of a bio-hygrothermal model for External Thermal Insulation Composite Systems (ETICS)

Summary

Bi-THEM project intended to define an innovative bio-hydrothermal model for External Thermal Insulation Composite Systems (ETICS). The biological susceptibility of ETICS was foreseen by knowing their composition and monitoring the environmental temperature and humidity.

Several humidity sensors and thermocouples were used, setting up experimental data loggers, with the aim of monitoring several ETICS specimens exposed to weathering. The selected specimens have different thermal insulations (EPS, ICB, MW), base coats (cement- or lime-based) and top coats (lime, acrylate or silicate). Specimens were placed outdoors in two ageing sites at LNEC (urban environment in Lisbon city centre) and FCT-NOVA (maritime environment in Caparica, southern Lisbon).

Additionally, low-cost sol-gel sensors, micro-fabricated at INESC-MN, were also tested to measure relative humidity, and results compared to commercial hygrometric sensors.

The hygrothermal performance of ETICS has been thus monitored over time (September to December 2020), identifying possible patterns among the composition of the ETICS, the formation of stains (generally due to the biological susceptibility of the substrate) and the variation of the humidity and temperature. The chemical-physical properties of the systems significantly influenced the durability and the appearance of possible anomalies on the ETICS.

Due to the COVID-19 pandemic, the conclusion of the project was postponed to 2021. Results were presented at an international conference (CEES 2021). The PhD candidate Júlia Pereira actively collaborated with the project, and a master dissertation (Francisco Gonçalves) was activated within this research topic. The development of bio-hygrothermal models was also continued within the PhD dissertation of João Luís Parracha.

The project intended, ultimately, to further explore the biological habitat of ETICS façades and to minimize the development of biological colonization on these constructive systems.

Figure 1. Evaluation of the hygrothermal conditions and of the biological colonization observed on External Thermal Insulation Composite Systems (ETICS).

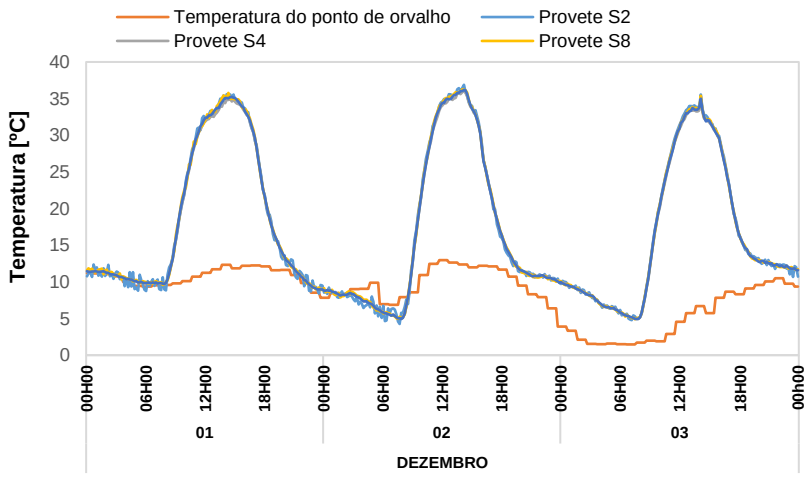

Figure 2. Surface temperatures and dew points of specimens exposed at LNEC aging site during December 2020.

Project Reference

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Leading Institution

CERIS – Civil Engineering Research and Innovation for Sustainability (Portugal)

Partners

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Funding

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Period

2020-2021

Total

7,500.00€

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Project Website

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