Long-term durability of External Thermal Insulation Composite Systems (ETICS): comparing the impact of natural exposure and accelerated climate aging

J L Parracha[1,2], **G Borsoi**[2], **I Flores-Colen**[1,*], **R Veiga**[1], **L Nunes**[1,3], **P Faria**[4], **A Dionísio**[5]

[1]National Laboratory for Civil Engineering, Lisbon, Portugal
[2]CERIS, DECivil, Instituto Superior Técnico, University of Lisbon, Lisbon, Portugal
[3]CE3C, Azorean Biodiversity Group, University of Azores, Azores, Portugal
[4]CERIS, DEC, School of Science and Technology, NOVA University of Lisbon, Caparica, Portugal
[5]CERENA, DECivil, Instituto Superior Técnico, University of Lisbon, Lisbon, Portugal

Email: ines.flores.colen@tecnico.ulisboa.pt*

Abstract. The use of External Thermal Insulation Composite Systems (ETICS) has been consistently growing over the last decade. However, these systems are frequently exposed to weathering and anthropic factors affecting their long-term durability. This study intends to evaluate and compare the durability of four commercially available and certified ETICS after one year of natural aging (at urban and maritime zones in Portugal) and after accelerated climate aging (hygrothermal cycles). The systems were selected in order to have different composition, i.e., thermal insulation (EPS, ICB, or MW), base coat (with cementitious or hydraulic lime binders), and finishing coat (acrylic, silicate, or lime-based). Physical and aesthetic properties of non-aged, naturally and artificially aged systems were experimentally assessed. The bio-susceptibility of ETICS rendering systems was also investigated. Results showed a significant loss of surface hydrophobicity after accelerated aging and traces of mold growth on the surface of the systems. The durability of the ETICS was significantly more affected after accelerated climate aging. Even though the amount of water for the accelerated and natural aging was quite similar, the moisture load happened in a much shorter timespan considering the hygrothermal artificial aging, leading to different impacts on the systems. These results, linked with the expected increase of extreme raining events derived from climate change, point out that ETICS could be more prone to premature failure and significant anomalies in the future. Furthermore, considerable color change for all systems was observed after aging, confirming aesthetic alteration. Results contribute toward the development of ETICS with enhanced durability.

1. Introduction

It is widely documented that construction and maintenance of buildings contribute to around 35% of global energy use, generating approximately 33% of world-wide greenhouse emissions [1]. As a result, sustainable environmental policies aiming at decreasing energy demand of buildings have been introduced by the European Union (EU). For example, the EU directive 2018/844 [2] points out the energy retrofitting of the building environment as one of the key targets to achieve a climate-neutral