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Thermal performance evaluation and comfort assessment of advanced aerogel as blown-in insulation for historic buildings

Elena Lucchi, Francesca Becherini, Maria Concetta Di Tuccio, Alexandra Troi, Jürgen Frick, Francesca Roberti, Carsten Hermann, Ian Fairnington, Giulia Mezzasalma, Luc Pockelé, Adriana Bernardi

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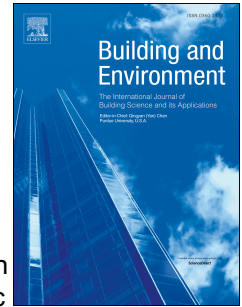
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TITLE**THERMAL PERFORMANCE EVALUATION AND COMFORT ASSESSMENT OF ADVANCED AEROGEL AS BLOWN-IN INSULATION FOR HISTORIC BUILDINGS**

Authors: Elena Lucchi³, Francesca Becherini^{1,*}, Maria Concetta Di Tuccio¹, Alexandra Troi³, Jürgen Frick⁵, Francesca Roberti³, Carsten Hermann⁴, Ian Fairnington⁶, Giulia Mezzasalma², Luc Pockelé², Adriana Bernardi¹

1: Institute of Atmospheric Sciences and Climate, National Research Council, Italy

2: R.E.D. srl, Italy

3: EURAC Research, Italy

4: Historic Environment Scotland, United Kingdom

5: Materials Testing Institute, University of Stuttgart, Germany

6: A. Proctor Group Ltd (APG), Scotland, United Kingdom

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ABSTRACT

Research and development of cost-effective, high-performance thermal insulation materials for the construction sector has to be focused on their final application. In particular, solutions for refurbishing historic buildings, which represent 40% of the European building stock, have to offer a good compromise between environmental quality, energy efficiency and conservation aspects. In this paper, the experimental assessment of an insulation material based on aerogel technology, recently developed in the European project EFFESUS, is presented with regard to the material's thermal performance, compatibility with historic fabric and reversibility. The overall results obtained in laboratory testing on a real-size mock-up and in a real-world case application indicate that the new material is a promising solution for retrofitting historic buildings, thanks to its thermal properties, easy application, reversibility and material compatibility.

1. INTRODUCTION

More than 40% of the European residential buildings have been constructed before the 1960s [1] and more than 50% before the 1970s [2]. European households are responsible for 68% of the total final energy use in buildings, mainly related to heating, cooling, hot water, cooking and appliances [1]. Most of the residential stock from before the 1970s is owner-occupied (from 46% to 97%), with a smaller but still substantial portion rented out (from 37% to 54%) [2]. The large proportion of occupied dwellings has an important role in the retrofit programs for reducing energy bills and costs, as well as for improving energy efficiency and human comfort. The European Directives 31/2010/CE [3] and 2012/27/EU [4] have shown the big potential to achieve energy savings and CO₂ emissions reduction through the refurbishment of existing buildings, besides the construction of new low-energy buildings [4]. The energy use is highest in those European countries which have the largest proportion of old buildings, such as the United Kingdom (UK), Denmark, Sweden, France, Czech Republic and Bulgaria [1]. In the case of historic buildings, the intervention should respect their historic values, balancing the needs of energy efficiency, human comfort, heritage preservation and long-term sustainability. This challenge is particularly relevant in the countries with the world's largest historic building stock, namely Italy, Spain and UK [5].

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