HEALTHIER LIFE WITH ECO-INNOVATIVE COMPONENTS FOR HOUSING CONSTRUCTIONS

Project Concept

The project has developed a variety of new multifunctional and flexible building components for a healthier indoor environment. [H] house solutions are durable, energy efficient, safe and affordable. They are suitable for use in new buildings and for renovation. [H] house solutions cover aspects of long service life, reduced maintenance and long-term improvement of energy efficiency.

UHPC-AAC Facade Elements

The UHPC-AAC composite elements offer a number of advantages such as strongly reduced thickness, light weight and improved durability. Fire safety is assured through the use of an integrated insulation layer based on inflammable AAC.

UHPC Cementitious Binder

The aim of the UHPC development was the highest possible replacement of Portland cement binder by SCMs considering a minimum compressive strength of 180 MPa. The research of the binder composition resulted in the [H] house Compound 5941 that is available for purchase in grey and white. With less than 55% Portland cement clinker, the embodied energy of the developed binder system is greatly reduced.

Self-Cleaning Surfaces

The granulometric optimization of the UHPC and an advanced casting technique allow a micro-structuring of the concrete surfaces. The combination with water-repellent agents directly applied on the textured formwork leads to a super hydrophobic UHPC that makes raindrops easily run-off and remove dirt deposits from the surface.

Life Cycle Assessment

The environmental impacts of the new UHPC-AAC elements were compared to those of a conventional rear-ventilated reinforced concrete cladding with mineral wool insulation having the same U-value of 0.15 W/(m²·K).

Acknowledgements

[H] house acknowledges the friendly support of: [H] house is a collaborative research project and has received funding from the European Union’s Seventh Framework Programme for research, technological development and demonstration under grant agreement no. 608893.

Marble flour paint / Casein primer (0.05 mm)
Earth fine plaster final coat (3 mm)
Earth adhesives / Flax fibre reinforcement (3 mm)
Wood fibreboard (22 mm)
Wood fibres insulation mat (60 mm) / Timber stud (80 mm x 40 mm, 37.5 cm distance)
Wood fibreboard (22 mm)
Earth adhesives / Flax fibre reinforcement (3 mm)
Earth fine plaster final coat (3 mm)
Marble flour paint / Casein primer (0.05 mm)

Total thickness of the wall build-up: 13.6 cm

Water Vapour Sorption Capacity

A new test method to determine the moisture sorption performance of internal partition walls has been developed. The specimen are undergoing five ad- and desorption cycles (12 h each) to identify the capacity and potential hydricress effects, while taking into account the potentially slower desorption process.

Comparison of the environmental impacts of UHPC-AAC composite element with conventional rear-ventilated reinforced concrete cladding with mineral wool insulation (LCA performed by CYCLECO)

Building component | Non-renewable energy | Global warming potential
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UHPC-AAC composite element | 1308 MJ/m² | 118 kg (CO₂ eq/m²)
Conventional solution (cladding/mineral wool) | 1586 MJ/m² | 123 kg (CO₂ eq/m²)
Saving of energy & CO₂ | 278 MJ/m² | 5 kg (CO₂ eq/m²)

Water vapour sorption test (following DIN 18947)

Result noise protection test: Rₚ(C;C₉₀) = 45 (-1; -6) dB