High Performance Insulation based on Nanostructure Encapsulation of Air

http://www.hipin.eu

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HIPIN Partners

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HIPIN - Overview

• Huge potential market for a highly insulating material for new buildings and retrofits that can satisfy the needs of high density housing and new insulation regulations in Europe.

• This opportunity can be met by new building materials containing aerogels that have very low thermal conductivity (< 0.01 W/(m·K) as a monolith and typically ~ 0.015-0.018 W/(m·K) in granular form)

Cost-effective route to a robust aerogel for use as an insulation material in buildings
HIPIN Technology

Manufacturing route to a robust silica aerogel

Cost-effective surface treatment to obtain hydrophobic aerogel

Optimisation of methodology for incorporation into:

a) water-borne systems (paint, plaster)
b) composite polymeric matrix (panels)

Incorporate aerogel granules into:
- Plaster
- Paint
- Panels
HIPIN Aerogel

Sol-gel technology to produce aerogel precursor with high silica content (60%), followed by proprietary method for SCD and surface treatment.

- Very low density (100-120 kg/m³)
- Low thermal conductivity (0.015 – 0.025 W/mK)
- Robust synthesis route – multiple batches made to scale up to thousands of litres aerogel
- Incorporated into a matrix system – paint, plaster, or polymer composite for panel
- Suitable for new & retrofitting buildings

Water Contact Angle:
A-hydrophilic, B-hydrophobic

A high silica content precursor for aerogels
Aerogel Synthesis

Flexible and cost-effective route for manufacturing of hydrophilic & hydrophobic aerogels

- Precursor
- Gelation
- Silica Gel
- Ageing
- xerogel
- SCD
- Hydrophilic aerogel

- Precursor
- Gelation
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- Separex proprietary technology
- SCD
- Hydrophobic aerogel
HIPIN Products

Plaster formulated with HIPIN aerogel

- $\lambda = 0.034 \text{ W/mK}$
- (standard plaster: 0.5 W/mK)

Paint formulated with HIPIN aerogel

- $\lambda = 0.49 \text{ W/mK}$
- (standard paint: 0.69 W/mK)

Panel composite containing HIPIN aerogel

- $\lambda = 0.025 \text{ W/mK}$
Case-Study – U-value comparisons

Wall-1A
U-value: 0.28 W/m² K

Wall-1B
U-value: 0.22 W/m² K

102mm brick
50mm air cavity
125mm AAC blocks
100mm mineral wool
30 mm plaster

Calculations using an approved calculator following EN ISO 6946:2007 & EN ISO 13370:200
U-value comparisons (contd.)

Wall-1C
U-value: 0.19 W/m² K

102mm brick
50mm air cavity
125mm AAC blocks
100mm Methodo panel
30 mm HIPIN plaster

30% of UK homes are solid wall constructions (BRE, 2008)

Can meet various European code regulations with 8-10cm HIPIN plaster on brick wall.

Calculations using an approved calculator following EN ISO 6946:2007 & EN ISO 13370:200
Demonstrators

- **Demonstrators** for all 3 applications at Envipark, Turin
  - Surface of 9-12m²
  - Maximize $\Delta T$ between internal and external environment (>15°C)
    (ISO 9869:1994 – “Thermal insulation – Building elements - In-situ measurement of thermal resistance and thermal transmittance”)
  - Protect sensors from direct sunlight for data accuracy
  - Data acquisition and analysis (Dec 2014 to Feb 2015)

Stakeholder Workshop at Envipark in Turin, Italy
March 10th, 2015

Joint workshop with ECO-SEE ([http://www.eco-see.eu](http://www.eco-see.eu))
Contact HIPIN coordinator ([sanjeev.naik@twi.co.uk](mailto:sanjeev.naik@twi.co.uk)) for more information.
Conclusions

• Aerogels offer new option for insulation applications in building envelopes, via incorporation into plaster, paint, and panel applications

• Incorporation of aerogel into plaster and panel can provide a means to meeting new building codes even for retrofits

HIPIN project ends in March 2015. Partners motivated to take this technology further and work with other companies to take this technology to market.
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