This project has received funding from the European Horizon 2020 research and innovation programme under grant agreement No 636239

AMANAC: Advanced Materials And Nanotechnology Cluster

Second Newsletter: **November 2015**

AMANAC NEWS AND EVENTS

AMANAC on ICAE 2015 and AMANAC FIRE WORKSHOP

May 27-29, 2015

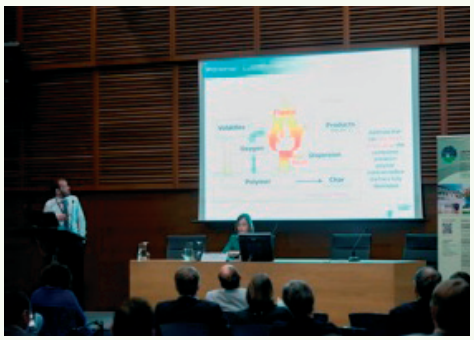
The Advanced Material and Nanotechnology Cluster (AMANAC), aiming to maximize the impact of the cluster participating projects towards the European Industry and Society, organized in collaboration with TECNALIA, the **AMANAC Projects Session** in the framework of the seventh International Congress on Architectural Envelopes (ICAE 2015), on May 27th 2015. Several AMANAC projects presented their results to new material developments and had the opportunity to exchange views and promote the scope of the Cluster. The Session covered 20 oral presentations and several posters. The abstracts were evaluated by an AMANAC Scientific committee.

More than 15 projects participated in the event and the audience comprised 60% researchers, 7% specifiers (architects and consulting engineers), 30% from the Industry sector and 3%, members of sector associations.

Addressed topics included:

- Buildings with low embodied energy materials
- Lightweight materials and components for construction
- Insulation systems
- Nano based HVAC systems
- Indoor Environment Quality
- Smart windows

As part of the AMANAC-CSA activities, **the AMANAC Fire Workshop**, organized in the frame of the seventh International Congress on Architectural Envelopes (ICAE 2015) with the contribution of 3 cluster project (AEROCOINS, ELISSA, NANOCOOL), was held on May 28th providing an opportunity for exchanging experiences and knowledge in the field of Fire Engineering. Four speakers, Prof. Alberto Fina (POLITO), Dr. Aitor Barrio (Tecnalia Research&Innovation), Prof. Michael Delichatsios (FIRESERT - ULSTER University) and Dr. Dionysis Kolaitis (National Technical University of Athens – NTUA) shared with the audience their knowledge in new trends in fire retardant materials, overview of fire characterization of materials, the state-of-the art and the future needs in façade fire tests as well as computational tools for fire research. More than 50 participants attended the event.



Financial Opportunity Workshop

November 5, 2015

The Workshop is organised by EC and AMANAC and it will be held on November 5th, 2015 at Covent Garden in Brussels, Belgium (COVE auditorium, ERCEA room 25 SDR1). The workshop aims to present funding opportunities for final stage or just finished AMANAC and/or advanced material projects. The participants will acquire understanding on the options, coaching, and various financing schemes which the European Commission or the Europe Enterprise Network can offer.

This workshop is free and is open to any member of AMANAC, and particularly to industrial partners who want to exploit their project results and bring new products/systems on the market.

Registration: Email Ms. Tasia Gkika (e-mail: **tgkika@central.ntua.gr**) to register. Prior registration is mandatory in order to issue an e-pass to the EC premises for all attendants.

AMANAC Standardization Workshop

8:40- 12:35, November 6, 2015

The workshop will be held on November 6th, 2015 at BIP For Rent (Room Agora), Rue Royale 2-4, 1000 Brussels, Belgium. A Standardization Workshop is to be held under the AMANAC--CSA to facilitate the discussion between key personnel from the various AMANAC projects, companies and institutes involved in standards and certifications. The perspective of end-users on the challenges with regards to standardization and certification will also be presented.

The number of participants is limited to 50 for the Standardization Workshop. The event is free.

This Workshop will be followed by a training course "Introduction to European Technical Assessment (ETA)", being coordinated by the EeB-CA2 in collaboration with EOTA.

Register for this workshop and the ETA Workshop (details below) at the Eventbrite link below.

Introduction to European Technical Assessment (ETA) - EeB-CA2 Workshop in collaboration with EOTA

13.30 - 17.15, November 6, 2015

The workshop will be held on November 6th, 2015 at BIP For Rent (Room Atomium), Rue Royale 2-4, 1000 Brussels, Belgium. In collaboration with the European Organisation for Technical Assessment (EOTA), EeB-CA2 will provide a training course to provide insights into ETA and the pathway to obtain a CE-mark for construction products. The training is tailored to coordinators and partners of EeB PPP and AMANAC projects, where current strategic considerations for laying the ground for successful further development and market uptake of project results may include a CE-mark in the near future. Typically, such project results are stated with TRL 6-7.

Registration:
You can book a spot for both events at:

http://www.eventbrite.de/e/amanac-standardization-workshop-and-eeb-ca2-training-introduction-to-european-technical-assessment-tickets-18837785323?utm_term=eventurl_textA

IEQ Thematic Stakeholder Workshop

February 18, 2016

The Indoor Air Quality (IAQ) Thematic projects of AMANAC, spearheaded by ECO-SEE project, will hold a Stakeholder Workshop on 18th February 2016 at Fraunhofer Offices in Munich, Germany. The theme of the workshop will be developments and innovations on materials to improve Indoor Environmental Quality (IEQ). The event is co-organised by Fraunhofer IBP and the University of Bath. In addition to ECO-SEE there will be presentations from BREMEE and H-HOUSE projects. Contact Pete Walker (**P.Walker@bath.ac.uk**) for further details.

Smart Facade Materials Conference at WSED

February 24, 2016

The Smart Facade Materials Conference is to be held on February 24, 2016 in Wels, Austria as part of World Sustainable Energy Days (WSED), a key event in Europe. This conference will be an effective way for AMANAC projects to disseminate project results via Presentations and via a booth at the Exhibition to showcase prototypes and samples from the projects and industrial partners within the projects.

For further details see:
http://www.wsed.at/en/programme/smart-facade-materials/

Registration:
For presentations, please write to Sanjeev Naik (**sanjeev.naik@twi.co.uk**) and for further details about exhibition opportunities you want to explore, please write to Monika Willert-Porada (**monika.willert-porada@uni-bayreuth.de**).

SUCCESSFUL STORIES FROM THE RESEARCH PROJECTS

Insulation & Smart Windows area

The development of cost-effective high insulation performance products and systems can contribute to improving the energy efficiency of buildings and to reducing CO_2 emissions in Europe.

According to the Buildings Performance Institute Europe (BPIE) the residential stock in Europe is the biggest segment and accounts for the 68% of the total final energy use in buildings. The majority of energy in a building is spent to satisfy heating and cooling demands accounting for 70% of the total final energy use. The energy performance of an average European building is poor, due to the fact that a high percentage of the European residential buildings were constructed before the 1960s, when energy building regulations were very limited, and have not undergone renovations to improve energy performance, meaning that these buildings have poor insulation levels and their systems are old and inefficient.

One method to improve the energy efficiency of buildings is to enhance the thermal resistance of the envelope. This can be achieved by: a) increasing the thickness of traditional materials something that is not always possible, as often, there are space limits; b) decreasing the thermal conductivity by using materials with lower thermal conductivity, thus, super-insulating materials such as aerogel and vacuum insulation panels (VIPs) and smart windows. For the same insulation performance, the thickness of the insulation layer is much thinner for the superinsulation materials in comparison to traditional materials.

Part of AMANAC Cluster projects focus on this specific thematic area "Insulation" focusing on the development of innovative materials and components based on aerogels and VIPs to improve the thermal insulation performance of the envelope of the building and maximize their energy performance in order to contribute to reduction of CO_2 emissions.

Windows are a weak link in the modern building envelope with typically higher U-values than façade elements. There is therefore an urgent need to develop new technologies for smart, lightweight, cost-effective and energy efficient windows based on novel material combinations and designs. A number of AMANAC projects focus on developing such smart window systems and will contribute to meet the energy efficiency targets of the building industry by 2020.

AEROCOINS - Aerogel-based composite/hybrid nanomaterials for cost-effective building superinsulation systems

June 2011-June 2015
Coordinator: TECNALIA; www.aerocoins.eu

Key Results:

Exploitable Results (ER)	Key Partner	Description of ER
Trityl cellulose aerogels and their silica-based composites	ARMINES France (RTD)	New reinforcement strategies for the silica based aerogels
Pectin-silica one-pot	EMPA Switzerland (RTD)	New reinforcement strategies for the silica based aerogels
Hot-wire characterization method suitable for small samples	ZAE Germany (RTD)	A modified hot-wire set-up that allows analysis of thermal conductivity for small samples down to about 3 cm in diameter at height of about 1 cm.
Profile-based facade insulation system for highly insulating materials	TECNALIA Spain (RTD)	State of the art dry internal insulation systems rely on metal or wooden profiles/studs to mechanically bear the system and render. These solutions tend to produce relevant thermal bridge effects (above 30% reduction of insulation capacity) when used in highly insulated façades, and traditional solutions are not applicable when highly insulating materials such as aerogels are used. AEROCOINs profile system is feasible for any superinsulation material.
Method of identification of critical stress point in ambient pressure drying	TUL Poland (University)	A method that identifies the critical stress point when wet gels crack during Ambient Pressure Drying (APD). The method is based on the experimental analysis performed in a tunnel that can measure drying kinetics of solvent saturated gels under variable conditions and measure internal pressure in gel as a representative of stress formation inside.

Exploitable Results (ER)	Key Partner	Description of ER
Knowledge for analysis, simulation procedures and sheltering principles	VTT Finland (RTD)	New materials have properties that differ from traditional materials, therefore, the building physics behaviours are also different. Reliable and verified simulation is one result of this research work within AEROCOINs. This can be used in all new superinsulation material concepts and also in different applications with different superinsulation materials. So it is not dependent of the material development in the project.

Summary:

Main project objective is to develop new composite/hybrid aerogel material to improve the insulating performance of existing buildings aiming at reducing their energy demands. The AEROCOINs project has developed new reinforcement strategies in order to produce mechanically strong super-insulating aerogel composite/hybrid materials. The main approaches developed are based on the employment of two polysaccharides materials: cellulose and pectin, respectively. These strategies open new possibilities for further development of superinsulating materials.

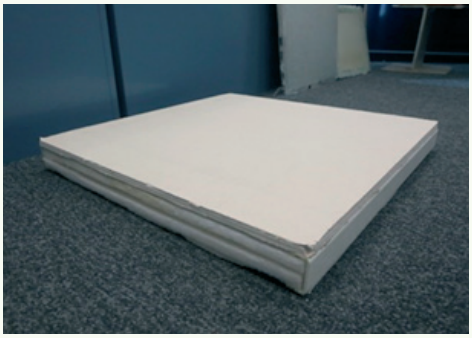
It was found in this project that the critical stress point when wet gels crack during Ambient Pressure Drying (APD) can be found by measuring the internal pressure evolution. This valuable information can be used to reduce the drying rate before the crack develops. In the current state-of-the art it is commonly assumed that this point roughly corresponds to transition from the constant to the falling rate period, which requires sample mass monitoring in situ.

For the thermal characterization of this type of highly insulating materials, an optimized hot-wire method has been developed within AEROCOINs, which permits the characterization of very small samples (down to diameters of about 27 mm). This method has been validated by comparing it to measurement with the same set-up on larger samples and comparing it to hot-plate results.

In addition, an efficient ambient pressure drying process and optimization on the supercritical drying process have allowed the up-scaling manufacture of aerogel boards. Designing and fabricating a novel building component prototype based on the developed aerogel-like material has yield a component compatible with conventional construction installations where the envelope is part of the buildings. This building component integrates low-conductive plastic-composite profiles and plasterboard renders within a multi-layer arrangement, and it has obtained the best fire classification for organic materials: B-s1,d0.

Demonstration of the structural, mechanical and thermal performance of the insulating component under real conditions have been performed in two demo buildings (in the DemoPark in Madrid and KUBIK in Bilbao) and compared with conventional insulating materials.

Project Pictures:



HIPIN - High Performance Insulation based on Nanostructure Encapsulation of Air

November 2011 - March 2015

Coordinator: TWI; www.hipin.eu

Key Results:

Exploitable Results (ER)	Key Partner	Key Performance Criteria
High silica content precursor (TEOS58)	Thomas Swan, UK (SME)	58% silica content compared to 28% for TEOS, usual precursor used in aerogel synthesis
Robust hydrophilicand hydro-phobic aerogel based on TEOS58	Separex, France (SME)	Cost-effective method for aerogel synthesis, with in-line surface treatment during supercritical drying step.
HIPIN Thermal insulating plaster	Vimark, Italy (SME)	Thermal conductivity, λ of 0.034 W/(m.K), compared to standard plaster which has a λ of ~ 0.5 W/(m.k)
HIPIN Thermal insulating panels	Methodo, Italy (SME)	PU-aerogel composite for making panels provided a 30-40% improvement in thermal conductivity over encapsulated polystyrene (EPS) board
Paint system with enhanced insulating properties	ICI (Akzo-Nobel), UK (LE)	Improvement of thermal conductivity of 24% was obtained compared to standard paint, without affecting other paint properties

Summary: The main objective is the development of a high silica content robust aerogel to incorporate into new affordable building materials such as paints, plasters, and panel systems to improve thermal efficiency in new and retrofitting buildings. The three building products which incorporate the novel aerogel demonstrate improved thermal performance and provide an opportunity to utilize the usually fragile aerogel in both new buildings and retrofits. The insulation benefits and performance of the three building products were established by setting up demonstrators at Environment Park in Turin, Italy. A detailed techno-economic study completed within the project highlighted that the long-term durability (for the plaster) and the cost of the aerogel are the key factors that will drive the commercial viability of the products.

With equivalent performance taken as the functional unit for analysis, a life-cycle analysis indicates that these novel building products compare favourably to existing comparable products. For example, HIPIN plaster, when compared to a commercial thermal insulating plaster (λ = 0.088 W/(mK)) gave a global warming potential (100 years) reduction of 87% and primary energy demand (PED) reduction of 47%.

Project Pictures:

VIP4ALL – Highly Sustainable and Effective Production of Innovative Low Cost Vacuum Insulation Panels for Zero Carbon Building Construction

October 2013 – September 2015

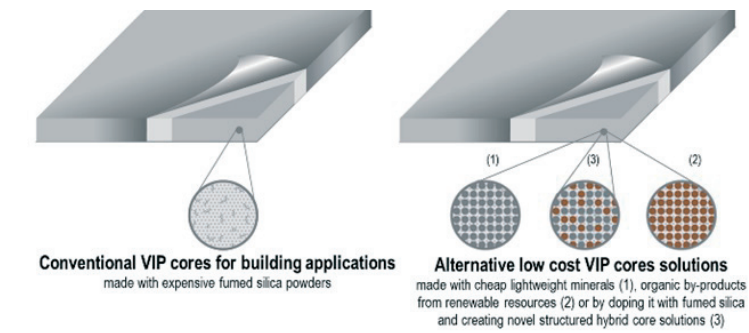
Coordinator: GARCIA RAMA; www.vip4all.com

Key Results:

Exploitable Results (ER)	Key Partner	Key Performance Criteria
Sustainable functional core systems for vacuum insulation products and their related processing technologies;	Brunel University, UK (RTD) Instituto Pedro Nunes, Portugal (RTD)	Develop new enhanced multi-level VIP core systems from low cost natural mineral resources and organic renewable/recyclable resources to replace standard high cost materials currently used.
Novel generation of thermal insulation vacuum panels called VIP4ALL	va-Q-Tec, Germany (SME)	Develop VIPs with low thermal conductivities, comparable to standard VIP solutions and life-time expectancy of at least 50 years, without losing significant thermal performance.Develop VIP4ALL with reduced production costs: cutting up to 50% the costs of the conventional silica VIPs, making VIP4ALL capable of competing in terms of price with standard fiber and polymer insulation products.Offer a new product to the retrofitting sector, capable of saving at least 3 times more living space. compared to conventional fiber insulation products.Achieve sustainable construction by using at least 50% of low energy renewable materials for the VIP product.
Software development	Brunel University, UK, (RTD) Instituto Pedro Nunes, Portugal (RTD)	Composition and performance simulation software to assist product development and market acceptance.

Summary: The aim of the proposed work was to select and preliminarily evaluate alternative core materials towards the generation of novel cost-effective VIP building solutions. Based on natural and sustainable materials, mainly in the form of residues, multi-level hybrid structured cores were envisaged, by partially or fully replacing the fumed silica content, allowing to cut considerable the raw materials production costs. A preliminary evaluation shows that cores having a 50-80% content of these alternative materials can present thermal conductivities close to those of pure fumed silica up to gas pressures around 10mbar. The outcomes of this work suggest a true potential upon the usage of these alternative powders to create less costly VIP with good insulating properties.

Project Pictures:



Conventional VIP cores for building applications
made with expensive fumed silica powders

Alternative low cost VIP cores solutions
made with cheap lightweight minerals (1), organic by-products from renewable resources (2) or by doping it with fumed silica and creating novel structured hybrid core solutions (3)

EnE-HVAC – Energy Efficient Heat Exchangers for HVAC Applications

October 2012 – September 2015

Coordinator: Danish Technological Institute; www.ene-hvac.eu

Key Results:

Exploitable Results (ER)	Key Partner	Key Performance Criteria
Anti-ice surface coatings	DTI, Tekniker IK4, LuVe SpA and Exhausto A/S	Significantly prolonged run time for air heat exchangers before over-icing.
Structured surfaces for enhanced pool boiling	DTI, Vahterus Oy	A large increase in heat transfer efficiencies have been demonstrated for developed surfaces using NH_3 and CO_2 as refrigerants
Technique for cost-effective nano- and microstructuring of large complex surfaces	DTI	Structures from 200nm-2000nm have been produced on 17m^2 of heat exchanger plates
Model for simulation of enhanced boiling and heat transfer effects	ESI Software Germany GmbH	Computer models have been developed for simulation and prediction of effects of enhanced surfaces in boiling heat transfer
Encapsulated phase change materials (PCMs)	Tekniker IK4	Inorganic encapsulation of PCM materials where demonstrated, yielding increased stability in brine systems
Chemical surface modification of NanoDiamonds	Carbodeon Oy	Miscibility tailored for and thus significantly enhanced in selected solvents including ammonia

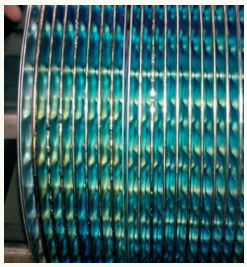
Summary: Main project goal is to improve the efficiency of currently applied state-of-the-art HVAC systems through development of new and innovative technologies for increasing the efficiency of currently applied state-of-the-art HVAC systems. The technologies developed and investigated are:

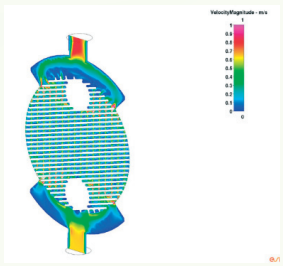
- Nanotechnological coatings with anti-freezing properties to limit over icing of heat exchangers.
- Nanostructured coatings including Sol-gels and PVD coatings for increased heat transfer.
- Nanofluids for the improvement of heat transport.

Developed surfaces have demonstrated significant improvements in the heat transfer efficiency in heat exchanger systems. For Anti-ice surfaces these systems have been demonstrated on full-scale air-air and air-liquid heat exchanger systems by Exhausto A/S and LuVe SpA and significantly prolonged uptimes and significantly smaller build-up of ice was observed. Techniques for structuring large complex surfaces have been developed and demonstrated on two full-scale heat exchanger systems each with a surface area of approx. 8.5m2. The effects of the structured surfaces on heat exchanger efficiencies where demonstrated in these full-scale systems at Vahterus Oy and DTI.

The development and use of computer models for prediction of boiling effects and heat transfer of enhanced surfaces as well as velocity, temperature, and pressure distributions within full heat exchanger systems where developed in tight collaboration between DTI, Vahterus Oy and ESI Software Germany GmbH.

Project Pictures:



HarWin - Harvesting solar energy with multifunctional glass-polymer windows

September 2012 - August 2015

Coordinator: University of Bayreuth; www.harwin-fp7.eu

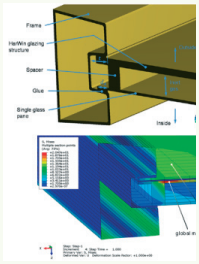
Key Results:

Exploitable Results (ER)	Key Partner	Key Performance Criteria
Glass particle reinforced composite polymer foils for thin glass lamination	UBT, GermanyInGlas (SME), Germany	PVB with stiffness varying from 10 MPa to 10 GPa, stable Tg, adjustable sound absorption, superior moisture barrier properties, haze comparable to pure PVB.
Thin glass reinforced laminate multiple glazing	UBT, GermanyInGlas (SME), Germany	Weight reduction of glazing by 50% (compared to triple glazing), U-value 0.50 W/m²K (Ar filling), safety glass features, noise protection
Light weight polymer-GF reinforced polymer foam frame	UBT (Germany), WUT (Poland), Isomatex (SME), Belgium	Thermal conductivity of the polymer-foam-polymer skin composite 0.05 W/mK,very high stiffness due to glass fibre reinforced polymer skin, light weight.
New LCEA methodology and simulation tool	JRC Ispra (Italy)	Feature specific tool for the eco-design of windows, multi criteria life cycle impact assessment, recycleability analysis method
Building simulation tool for HarWin glazing	International Environmental Solutions, IES (SME), UK	HarWin type windows data base implemented into building performance model, LCC analysis for new window type included. Cost reduction for refurbishment of buildings demonstrated.

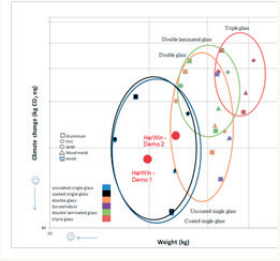
Summary: Main project objective is the development of light weight reinforced thin glass pane laminated glazing and polymer-glass composite frames to significantly reduce the overall weight of windows while further improving their U-value and visible light transmission. In HarWin new materials and simulation methods have been developed for next generation light weight windows. These windows reduce significantly the embodied energy of windows and enable extension of window functionality. The improvements are based on reduced weight and thermal conductivity, improved weight specific mechanical performance along with added functionality, like wavelength specific energy management, including wave length conversion with coatings but also with a new active luminescent glass. A data base and a simulation tool which is including End of Life recycle ability of materials were developed for LCEA analysis of HarWin windows. In addition, a HarWin window module for building performance simulation has been implemented into existing sophisticated building performance software, based on extensive characterisation of optical and thermal properties of HarWin windows. For the new materials a data base has also been implemented into a cost analysis tool. The benefits of the light weight glazing and frame materials in terms of energy and cost savings and in particular for refurbishment of old buildings were clearly demonstrated. For energy harvesting with the help of phase changing materials a thorough analysis of inorganic and organic materials has been accomplished, showing the superiority of organic materials for achievement of high light transmission.

Project Pictures:

Light weight double-glazing



Light weight frame: LCEA guided design



LCEA tool

MEM4WIN - Ultra thin glass membranes for advanced, adjustable and affordable quadruple glazing windows for zero-energy buildings

October 2012 - March 2016

Coordinator: LiSEC Austria GmbH; www.mem4win.org.com

Key Results:

Exploitable Results (ER)	Key Partner	Key Performance Criteria
Tempered ultra-thin glass membranes	LiSEC	~ 0.9 mm thickness up to 40% energy savings in comparison with conventional tempering furnaces. Minimum optical distortions (no roller waves)
Novel lamination techno-logy for encapsulation of functional layers in glass-glass modules	LiSEC	~0.01 g/m²day water vapour diffusion tightness ~4 min cycle time
Quadruple insulated glass unit with novel spacer technology	LiSEC	0.3 W/m²K Ug-value ~0.60%/a gas loss rate
Frame-less, openable window for application in facades	LiSEC	Openable wing not visible in the façadeLow distortions in the appearance of the façade due to asymmetric construction of the IG-unit
CVD Graphene for direct transferred transparent contacts	Aixtron	~ 20 Ω/□ sheet resistance ~ 90% transparency
LPE Graphene ink for direct inkjet printed printed hole-transport-layer in OPV modules	TIGER Coatings	> 1 g/L solid content Printhead compatible solvents
OPV glass-glass module with direct inkjet printed organic photovoltaic cells	Belectric OPV	Freedom of design ~ 30 years lifetime ~ 3% module efficiency
Industrial large-format inkjet printer for direct printing of active OPV layer on window glass	DURST	160 cm printing width 1000 dpi resolution up to 100 m²/hour productivity
Micro mirror arrays for control of solar radiation and light guidance	University of Kassel	< 0,1mm² mirror area, which means about 12.000.000 mirrors / m² <1 mW/m² power consumption in holding positionat least 75% and 2% transmission (open and closed)
Solar-thermal collector (fully integrated in IG-unit)	Energy Glas	> 80% optical efficiency > 300 W energy gain (vertical façade integration) < 50mb drop in pressure

Summary: Objective MEM4WIN are:

(1) To introduce a novel IG-Unit for quadruple glazing containing ultra-thin glass membranes dedicated as frameless openable windows for direct application in facades. Due to this approach U-values of 0.3 W/m²K can be achieved reducing weight by more than 50% and costs by 20%.

(2) To implement ink-jet printed organic photovoltaics (OPVs) and fully integrated solar thermal collectors for energy harvesting and micro mirrors for energy control and advances day lighting.

(3) Fabrication costs will further be reduced by replacing conventional and cost intensive materials used for contacts like ITO and silver by graphene. MEM4WIN will introduce production methods like roll-to-plate transfer printing and ink-jet printing to fabricate contacts for OPVs.

At the end of the project the aforementioned modular components like micro mirrors, OPVs, solar thermal collector as well as organic light emitting diodes (OLEDs) will be integrated into a demonstrator of 1230 x 1480 mm size showing the suitability of the used equipment, processes and new materials developed within MEM4WIN.

Project Pictures: Photos of exhibited preliminary results, © PROFACTOR

Embodied Energy & Indoor Environment Area

High levels of indoor environmental quality and energy efficiency in buildings are the pillars of a sustainable, green and healthy built environment. The integration of innovative and eco-friendly materials and solutions, together with a novel and knowledgeable approach of construction sector devoted to reduce the consumption of natural recourses in terms of energy and raw materials, is the main way to improve the level of sustainability of next-generation buildings. Some of the AMANAC Cluster projects focus on these two specific thematic areas “Indoor Environment“ and “Low Embodied Energy materials”.

Regarding energy efficiency in buildings, nowadays the embodied energy of materials and operating energy of buildings represent a huge amount of energy consumption. The construction industry is one of the largest consumers of energy and raw materials, and one of major contributor to the emission of greenhouse gases. Improvements in insulation and boiler efficiency now mean that the energy associated with the production of the materials used to construct a building are a significant proportion of the total energy consumed by the building during its life. By using low embodied energy construction materials the total energy use of a building can be reduced. However, the new materials must perform as well as or better than existing technologies and need to be lower in cost. The re-use of waste materials is an important route to achieving these goals.

Together with energy efficiency, it is fundamental considering the level of quality of indoor built space. Unfortunately, the issue of indoor air pollution has been largely overshadowed by the attention focused on air pollution outdoors related to industrial and transport emissions. In reality indoor air quality is influenced not only by penetrating outdoor air but also by specific indoor pollution sources, interactions between building system/construction techniques and occupants. For this reason the “Indoor Environment” thematic area projects focus on the development of innovative materials and components to reduce the presence of harmful chemicals in internal environment and novel solutions for better monitoring the indoor environment quality.

BioBuild- High Performance, Econimical and Sustainable Biocomposite Building Materials

December 2011 - May 2015

Coordinator: NetComposites; www.biobuildproject.eu

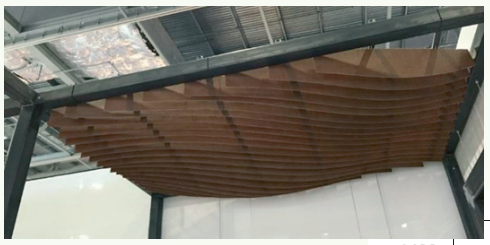
Key Results:

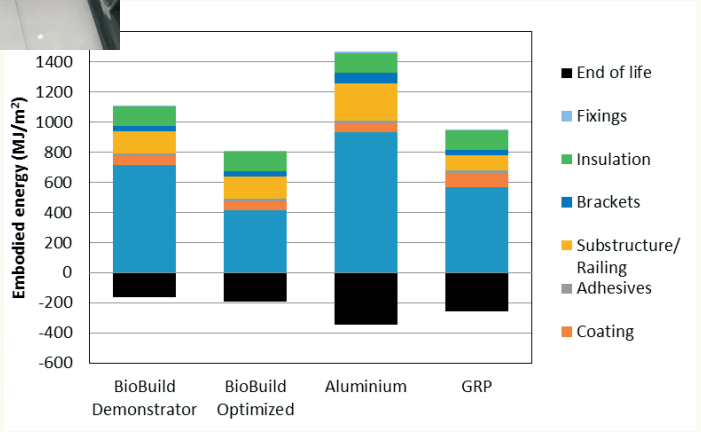
Exploitable Results (ER)	Key Partner	Key Performance Criteria
Process for producing pre-pregs of polyfur-furyl alcohol resin and woven natural fibre fabrics (with or without FR additives)	NetComposites	Cured mechanical properties greater than the same thickness of timber. Fire performance: Euroclass B-s1, d0
Quickscan tool to convey & compare environ-mental sustainability data into the design of building components and system	TNO, Aup & GXN	Flexible software tool to rapidly produce LCA assessment on assembled systems based on partial data at design stage
Methods of chemical & plasma treatment of natural fibres for improvement of moisture resistance and compatibility with resins	KUL	Increase in transverse three point bend strength by a factor of 10. Reduction in water uptake by a factor of 3.

Summary: The aim of BioBuild was to develop novel building components based on biocomposite materials in order to reduce the embodied energy of construction products. To achieve this the perceived shortcomings of biobased materials, such as poor performance in fire and susceptibility to degradation by weather, had to be addressed by fibre treatments, additives or coatings (as one would do with wood).

Significant improvements were made in the science of fibre treatment and the production of biocomposite components. The desired levels of performance were achieved through the use of functional fillers, coatings or fibre treatments. A 50% reduction in embodied energy can be achieved by the use of composites of polyfurfuryl alcohol resins and jute fibre fabrics.

Project Pictures:





LEEMA – Low Embodied Energy Insulation Materials and Masonry Components for Energy Efficient Buildings

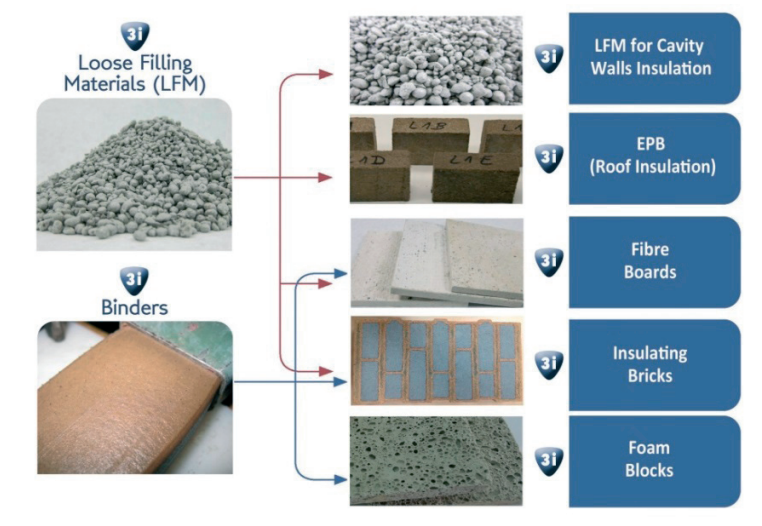
January 2012 – December 2015

Coordinator: S&B Industrial Minerals; www.leema.eu

Key Results:

Exploitable Results (ER)	Key Partner	Key Performance Criteria
3I Loose Filling Materials for cavity walls	SandB, GR (LE)	"3I" Loose Filling materials for use as cavity walls insulation or as lightweight aggregate in various insulation and building products (boards, bricks etc.). LBD: 62 kg/m3 and λ=0.038W/mK
3I Binder for building products	NTUA, GR (University)	"3I" binders, based on mineral wastes, to replace cementitious and clay-based binders in various building products (such as bricks or boards), easy to shape by current methods (casting or extrusion)
3I Foamed Blocks	FIBRAN, GR (LE)	"3I" Foamed blocks based on mineral wastes, for use as lightweight and insulating masonry components. Density~700kg/m3 and λ=0.1 W/mK
3I EPBs	SandB, GR (LE)	"3I" EPBs ("expanded perlite boards") replacing expanded perlite with 3I Loose Filling materials
3I Fibre Boards with 3I LFM	ETEX, BE (LE)	"3I" fibre Boards, replacing expanded perlite with the new 3I Loose Filling materials.
3I Fibre Boards with 3I binder and 3I LFM	ETEX, BE (LE)	"3I" fibre Boards, combining an inorganic polymer binder and 3I Loose Filling materials.
3I Bricks with 3I LFM	SCHLAG, DE (LE)	"3I" Bricks, consisting of a clay brick body and 3I Loose Filling materials filling. λ=0.035W/mK (in insulation filling)
3I Bricks with 3I binder and 3I LFM	SCHLAG, DE (LE)	"3I" Bricks, consisting of an inorganic polymer brick body and 3I Loose Filling materials filling.

Summary: Within the LEEMA project a number of new building components were developed based on the novel 3I materials (Inorganic, Insulating and Incombustible). The 3I materials are produced by inorganic polymerization and by utilizing mineral tailings and industrial by-products which allows them to have significantly lower embodied energy. A new insulation product has been developed as Loose Filling material for cavity walls insulation that exhibits similar performance to commercial organic counterparts (EPB) and up to 76% reduced embodied energy. A new fibre cement board has been developed of lower density, higher thermal insulation and lower embodied energy. Also, a thermal insulating brick was developed with an overall λ value ≤ 0.090 W/(mK) and at least 10-15% lower embodied energy vs current solutions while in a more futuristic approach, which has been proven in concept, the whole brick will consist of geopolymer (60% less embodied energy). Additionally, a new foam block to replace aerated concrete blocks with at least 50% less embodied energy was designed.



SUS-CON – Sustainable, Innovative and Energy-Efficient Concrete, based on the Integration of All-Waste materials

January 2012 – December 2015
Coordinator: CETMA; www.sus-con.eu

Key Results:

Exploitable Results (ER)	Key Partner	Key Performance Criteria
New SUS-CON lightweight aggregates from solid waste	CETMA, Italy (RTD)ACCIONA, Spain (LE)IRIDEX, Romania (SME)	• Cost effectiveness • Lightness • Thermal insulation
Novel SUS-CON geopolymer binders	NTUA, Greece (RTD)QUB, UK (RTD)	• Cost effectiveness • Low energy consumption • Reduced CO_2 emissions
Novel SUS-CONall-waste concrete	CETMA, Italy (RTD) MAGNETTI, Italy (LE)ACCIONA, Spain (LE)QUB, UK (RTD)IRIDEX, Romania (SME)ISTON, Turkey (LE)NTUA, Greece (RTD)S&B Industrial Minerals (part of Imerys group), Greece (LE)	• 100% waste concrete • Reduction of carbon footprint (50%) • Increment of thermal insulation • Reduced tendency to transmit ultrasounds • Suitable for both ready-mixed and pre-casted applications
Decision-support tool within information on waste in Europe and on new SUS-CON concrete	TRE, Italy (RTD)	

Summary: The overall goal of project is the development of new technology routes to integrate waste materials (aggregates and binders) in the production cycle of concrete, for both ready-mixed and pre-cast applications to manufacture a sustainable, innovative and energy-efficient concrete made by all-waste raw materials. The main exploitable results of SUS-CON project concern a **novel type of aggregates** composed completed **of waste materials** (mixed plastic waste, Waste Electrical and Electronic Equipment – WEEE, waste polyurethane foams and scraps of the sorting process of Municipal Solid Waste - MSW), **novel geopolymeric binders** made of waste only, **novel all-waste concrete** and finally a **Decision Support tool** to manage and share EU streams wastes data and SUS-CON concrete technical information.

The lightweight, eco-compatible, cost-efficient and all-waste concrete (realized with novel SUS-CON binder and aggregates) is applicable for both ready-mixed products (floor screed and floor screed underlay) and pre-casted applications (blocks and panels).The SUS-CON concrete, in comparison with other existing lightweight concretes, has a good performance in terms of:

- Decrease of the **embodied energy**, especially by the substitution of the cement (15%)
- Decrease of the **CO_2 footprint** by the reduction of raw materials processing (50%)
- Improvement of the **insulation properties** (due to novel aggregates)
- Increase of **cost effectiveness** (due to lower costs of the raw materials)




CETIEB - Cost-Effective Tools for Better Indoor Environment in Retrofitted Energy Efficient Buildings

October 2011 - September 2014

Coordinator: USTUTT (MPA); www.cetieb.eu

Key Results:

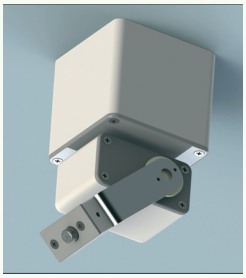
Exploitable Results (ER)	Key Partner	Key Performance Criteria
Wireless monitoring system	Smartmote, D (SME)	Extended to indoor climate application; Inclusion of advanced sensors (VOC, Thermal comfort, RGB for colour assessment)
Thermal comfort infrared vision system	UNIVPM, I (University)	Patent applied; Spin-off planned;Demonstration with Active Control System - 15% energy savings
MEMS based VOC spectrometer	Infratec, D (SME) Fraunhofer IPM, D (RTD)	Tunable IR optical gas sensor for VOCs (detection limit: > 2 ppm); Cooperation with industry on air quality sensing, medical gas analysis, health and safety technology
Air Biofilter	DWEcoCo, IRL (SME)	Reduction of VOCs demonstrated;For use in office environments
Mineral based thermal insulation plaster system with thermal storage and photocatalytic behaviour	Schwenk, D (Industry) S&B, GR (Industry)	Thermal conductivity λ = 0.074 W/m*K (comparable with EPS plasters); Product in application phase further improved: λ = 0.055 W/m*K; indoor / outdoor (pilot), available on the market 2016
Natural Light Illumination System	NTUST, TWN (University)	4 patents applied;Demonstration in Taipei (TWN) at a prominent university building; Demonstration in Europe planned - Eco-shopping, Sopron, Hungary

AMANAC:
Advanced Materials And Nanotechnology Cluster

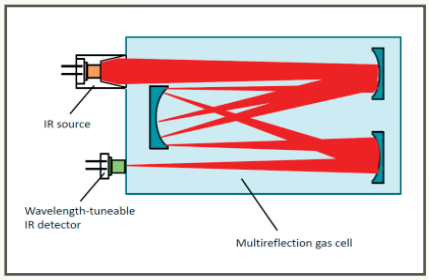
Second Newsletter: **November 2015**

Summary: CETIEB addressed three main objectives: a) Development of monitoring systems (wireless and/or partly wired) to detect insufficient comfort and health factors. A modular version allows a cost-effective adaptation for different monitoring tasks; b) Development of control systems for indoor environments, using both passive elements like cost-effective photo-catalytic materials or phase change materials, and active systems which control the air flow rates based on the monitoring data. In addition, a plant based system was implemented; c) Modelling of indoor environments to assess and validate monitored data and to optimize control parameters and systems for energy efficiency. The focus was on cost-effective solutions to ensure a wide application. The project demonstrated in real buildings the efficiency of technologies and systems developed, and disseminated results and recommendations for new policies and regulations within the EU.

Monitoring scheme



IR scanning system



VOC spectrometer cell

Light collecting element

COORDINATOR CONTACT

NATIONAL TECHNICAL UNIVERSITY
OF ATHENS
Prof. Maria Founti
T: +30-210-772-3605
E: mfou@central.ntua.gr
Location: SCHOOL OF MECHANICAL
ENGINEERING, HEROON POLYTECHNIOU
9-15780 ATHENS, GREECE

PROJECT INFORMATION

Project Acronym: AMANAC
Grant no: 636239
Start Date: 2015-01-01
Duration: 24 months
Project Cost: 479 530 €
Project Funding: 479 530 €
Website www.amanac.eu

DISCOVER AMANAC

www.amanac.eu

PARTNERS