National School of Architecture, Nancy

Building with composite for architecture

Cycle 2017-2021

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ARCHITECTURE NANCY

Preamble
Composites and architecture: context and challenges of a structural use

Composite
The word composite, is understood here, as a material consisting of at least two non-miscible components, a matrix material and a reinforcing material, assembled artificially and collaborating structurally. It covers synthetic polymer matrix composites and opens up with current research to natural polymers, implemented artificially with reinforcements, possibly biosourced.

To date, composite materials are seldom used in building structure in the field of architecture. They are little known by clients and project teams and they are inexistent in teaching and research at French national schools of Architecture.

Many experimental applications were developed worldwide during the 1960s and 1970s. Today, some realisations have benefited from recent research and development in the domain of civil engineering.

The composites specific qualities –mechanical, thermal, water and vapour-proofing capacity–, strength-to-weight ratio, low maintenance cost all make them an extremely high-performance and very competitive material in the new context of architectural production. In addition, current research on composites (bio-sourcing, recyclability, environmental assessment), the advancement of forming and construction processes, the advancement of calculation tools, characterization and non-destructive testing tools and the development of metacomposites, offer new perspectives for a structural application of composites in architecture.

Social and demographic changes, urban densification and the challenges of energy transition all create a stimulating context for finding new constructive solutions and systems.

This sector of activity is potentially very competitive if it is used to develop, in conjunction with architects, structural solutions which favour the sustainability of the building projects.

The cycle “Composite construction for architecture” proposes taking stock of the structural use of composite materials in architecture, a sector that is little known in architecture but which has a high potential.
The cycle will contribute to the development of the composite sector for architectural construction.

Cycle objectives

This cycle aims at exchanging, developing and pooling knowledge and approaches for architecture on the use of these materials both as structure and as structural envelopes.

The cycle proposes to bring together different actors (research laboratories, universities, companies, engineering firms, trade and architects) interested in composite construction for architecture.

It thus contributes to the convergence of science and practice and to reinforcing the monitoring of emerging or constructed knowledge.

Indeed, the absence of a structured scientific and professional network for architectural production in composites, constitutes a barrier for the circulation of knowledge and to the development of innovative practices. In this context, it is important to construct a space for dialogue between the different actors in this domain.

The meetings will take the form of international study days and colloquia.

Meeting 1 / Start of 2017 term
Building with Composites for Architecture: What›s New Today?
(Presented hereafter)

Meeting 2 / 2018
Prospective Materials and Processes: bio-composites, meta-composites, robotics, What are the challenges for sustainable architecture?

Meeting 3 / 2019
The performance of composites in relation to fire resistance and behavior, acoustics, summer cooling loads, environment: state of play of recent advances in research and evaluation of applications.

Meeting 4 / 2020
Focus on on-site assembly and built-in functions.

Meeting 5 / 2021
The composite in the collective imagination along with user feedback and experience. A lived experience approach, semiotic and symbolic of composite construction.

This provisional program will be adjusted according to current events and developments in the field of activity concerned.

The first international day, planned for the start of the 2017 term, has a general aim. It will attempt to situate the structural use of composite materials in the history of architecture up to the present day, to take stock of the constraints and issues of its use and to identify, through various build examples, the specificity of design using composites for architecture.

Day 1. presentation

“Building with composites for architecture, what is the state of affairs today?”

Intended audience
Academics, manufacturers (industrialists), trade unions, students; in various fields such as architecture, engineering, art, history, chemistry, physics, semiology, economy.

Axis 1
History: fabrication technologies, materials, built examples, political context.

Axis 2
Contemporary building: testimonials, feedback, evaluations.

Axis 3
Architectural design with composite: which specificity?

Axis 4
Limits and challenges of composite structural use for architecture today.

The Historical axis aims to capitalise the knowledge of the structural use of the composite in architecture from the point of view of design, production and reception, from the 1950s to the present day. It will question the legacy of past experiments from the point of view of architectural and constructive knowledge and he genesis of the context of our research and development in architecture (institutional space, education, industry).

The contemporary building projects axis will present real life testimonials, in urban renovation, new construction or densification. It will shed light on the contexts of production (know-how, economy, politics), evaluation (technical performance, fire resistance, recyclability and minimum impact at the end of life), as well as on the specific suitability to the existing physical context (urban tissue, soil…).

The Design axis will examine the basis of the specificity of design in composite materials in architecture.

The Limits and Challenges axis will try to identify the limits and the challenges of a structural use of the composite in architecture today. It will focus on the question of the structuring of the sector and the stakeholders, the reception (sociology, semiology) and the economy and the national political orientations.
It will compile the catalogue of significant advances that enable these materials to meet the challenges facing today’s society (environmental performance, spatial qualities, etc.).

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This cycle articulates from the research "Building Composite for Architecture", initiated and developed in collaboration with *Artificial Architecture*. Phase 1 of this research has benefited from a research fund of the National Superior School of Architecture in Nancy (ÉNSAN). It has also benefited from a grant from the Région Lorraine for the subject of "European Valley of Materials, Energy and Processes" in its strategy to re-industrialize the territory.
Meeting 1 is funded by the Office of Architectural, Urban and Landscape Research (BRAUP) of the Ministry of Culture and Communication.

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