FP9 2021-2027 POSITION PAPER

INTRODUCTION

As part of the European Construction, built environment and energy efficient building Technology Platform ECTP, the Material and Sustainability (M&S) Committee developed a common Vision and Strategic Research Agenda for all construction material stakeholders as summarized in this Position Paper to provide insight into current and upcoming construction material related key-challenges that we strongly believe deserve to be addressed within FP9.

The Position Paper builds on key societal challenges which clearly need to be addressed over the next decade and where innovations in construction materials will make a difference: Climate change, circular economy and resource preservation, competitiveness and economic viability, health and safety, and user comfort are the five key missions that were identified as the main drivers for action. The paper also addresses an additional mission dedicated to evaluate, to ensure and to valorise the performance of the new material related innovations for sustainable constructions.

PRIORITY TOPICS FP9 2021-2027

Climate change

A holistic view along the whole life cycle of construction materials and along the whole value chain needs to be adopted to minimize climate change related impacts. This, using Life Cycle Analysis (LCA), applies to a broad range of construction materials used in different applications such as in buildings, cities, infrastructures, energy applications and possibly others. The focus must be directed toward both the reduction of embodied energy and of the energy in use, reducing the gap of CO2 emissions between (building) design and actual performance.

Furthermore, materials to facilitate the energy transition to renewables must be pushed. This includes materials e.g. for new power plants and for energy transport and distribution.

Fig. 1: Powercrete®, a high performance heat conducting concrete used for HV and UHV underground cabling to improve energy transport and distribution

Circular economy and resource preservation

Construction materials are produced in huge amounts (e.g. cement ~4 billion tons and steel ~1.5 billion tons annually) and mostly from non-renewable resources. Applications include buildings, transport- and energy infrastructures. Given the huge amounts of natural resources involved it is very important that an increasing effort is made to align construction material production with circular economy principles. Innovation in resource efficiency needs to start at the design phase of a construction to allow for optimum material recovery and use at the end of the construction's life. Material traceability is an important challenge and may be tackled via implementing digital technologies enabling to tag materials and/or construction parts and to store the data in (open-sourced) databanks. However, R&D continues to remain important at all levels of the waste hierarchy to ensure making our economy more circular. This includes – depending on the material – R&D on recycling, reuse, energy recovery and remanufacturing.

Competitiveness and economic viability

The European Commission estimates that 70% of product innovation across all industries is derived from new or improved materials. With approximately one-third of construction costs attributed to construction materials, the scope for applying advanced and more-efficient building materials is considerable, not only in use, but also at the level of production processes. A key factor for maintaining and improving competitiveness of the European construction materials industry is to analyse and reduce Life Cycle Costs (LCC). The development of materials contributing to reducing operational and maintenance costs as well as energy harvesting is an important topic for the construction industry.

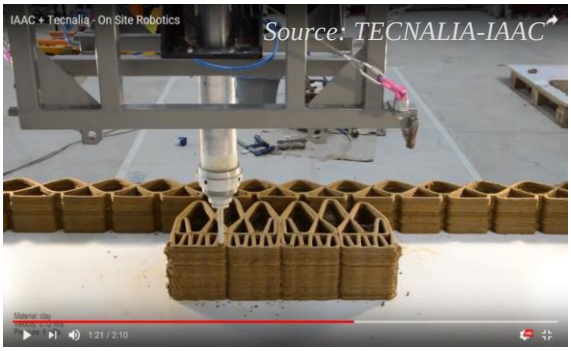

Fig. 2: Materials for additive manufacturing in construction

Health & safety

The provision of healthy and hygienic structures to live and work is a crucially important issue for the construction sector in the coming years. Considering the impact of materials on environment and health, much of this relates to the quality of the breathing air and ventilation particularly in offices and residential buildings. The development and application of functionalized covers or envelopes, such as nano-coatings, incorporating shelf-properties, is now a reality and significant further innovations in this area are expected over the coming decades. The development and industrial uptake of new functionalities, such as surface-active materials, self-healing capacities, sensor technologies, thermal, sealing etc. are indeed still in their infancy. Multi-functional/smart construction materials can be a support for the globally

aging population, which more and more desires to live in their houses. Examples can be materials for sight-impaired, internal or external anti-slip paving and easy to clean surfaces.

In addition, safety in building and infrastructures (minimal danger or risk of harm related to natural hazards, seismic events, fire, structural ageing, radiation, etc.) should be considered as an important task of future materials, in particular for application and refurbishment interventions in seismic areas and to mitigate the effect of natural hazards. Innovation in materials can also significantly improve safety of workers at the building site, by reducing the operational effects of heavy weights, repetitive movements, noise, vibrations etc. (e.g. light materials, improved prefabrication and joining technologies).

User comfort

In developed societies, people spend on average over 90% of their time indoors and most of the remaining time in urban built environments. Therefore, indoor and urban outdoor environment quality is a major impact factor for the comfort of people, which influences productivity and wellbeing. Improved and smart materials can improve comfort of living (e.g. by automatically regulate thermal and moisture levels), well-being and user experiences considering all relevant dimensions of the Indoor Environmental Quality (IEQ), including air quality, visual performances, noise, subjective perception, etc.

Enabling robust and fast innovation in construction

This sixth "horizontal" mission is focusing on approaches enabling to evaluate, ensure and valorise performance of the (new) materials. Performance validation for structural and functional reliability of constructions is of paramount importance, including standardised accelerated aging tests, field exposure sites, living labs, mock-ups and monitoring pilots. The ultimate goal is to improve understanding and accurately model performances and service life. A systematic approach, including integration of design, material and LCA/LCCA via extensions of BIM models, is necessary to ensure successful valorisation of innovations in the built environment.

Fig.3: Experimental platform located at the French National Institute of Solar Energy (INES) near Chambery / France. The experimental platform is used for testing novel materials and systems, e.g. by the EU funded HOMESKIN project (https://homeskin.net/) in their development of thinner insulation systems and by other EU-funded projects