Textile reinforced silicate composites – challenge and opportunity

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ABSTRACT

Recent developments and changes in natural and socio-economic environment require new technical solutions for construction of new and modernization of existing structures. Concrete and new advanced types of silicate composites gradually become building materials with high potential for new technical solutions resulting in needed environmental impact reduction and consequent social and economic improvement.

New composite high performance silicate materials composed from HPC or UHPC and non-corrosive textile reinforcements can be used in the thin "shell" form. This enables design of elements with significantly reduced use of materials and consequently it leads to reduction of environmental impacts. Thanks to the favourable properties of this composite material, it can bring considerable advantage to the durability and thereby it can favourably affect the environmental impact.

Results of presented experimental investigation show a big potential of this advanced composite material for wider application in the construction practice. Carbon textile reinforcement has impressive mechanical parameters. The yarn data sheets show 4900 MPa tensile strength and 230 GPa modulus of elasticity and performed partial experiments confirmed these parameters. Used high-performance concrete mixture has a compressive strength measured on cubes with the edge length of 100 mm 140.3 MPa. Such mechanical properties predetermine these composites (in the form of textile reinforced concrete - TRC) for some specific applications in building construction.

The presentation will show some results of experimental investigation leading to development of structural elements using TRC. First developed lightweight slightly reinforced concrete elements were designed for non-load-bearing structures like elements of garden architecture, street furniture or facade elements. Next development could be focused on load bearing elements with higher amount of reinforcement also in more layers in combination with bar composite reinforcement. However, it will need developments of standards for design of structures using this new composite material.

BIOGRAPHY

Petr Hájek is Professor of Civil Engineering at Czech Technical University (CTU) in Prague, Faculty of Civil Engineering. Head of Department of Building Structures and Head of Laboratory of Composite Structures at University Centre for Energy Efficient Buildings.

Petr Hajek is a member of Technical Council of fib (International Federation for Structural Concrete) – chairman of Commission 7 Sustainability and head of TG 7.1 Sustainable Concrete Structures. Since 2005 he is a board member of iiSBE – International Initiative for Sustainable Built Environment and chairman of CSBS

iiSBE Czech – Czech Sustainable Building Society. He is a board member of Czech Concrete Society and chairman of editorial board of journal Beton TKS. P. Hajek has been a head of 13 research projects and co-researcher of 22 other research projects in the field of concrete sustainability and sustainability performance of buildings.

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- Research Interest:

  Sustainable construction of buildings, sustainable concrete structures, utilisation of advanced silicate composites, TRC, utilisation of recycled materials, LCA and complex assessment of building performance quality.