

C³ – Carbon Concrete Composite

The building industry has hardly changed since the introduction of reinforced concrete. Due to corrosion the service life of reinforced concrete structures remains far behind earlier expectations - many buildings barely get older than humans and, additionally, have a high resource and energy consumption. More than 100 million cubic meters are built with reinforced concrete. It is therefore the most important building material in Germany. Concrete is the material most commonly used after water in the world which has always led to a high consumption of raw materials. In addition it leads to enormous CO₂ emissions. The production of cement is responsible for 6.5 % of the total carbon dioxide emissions. That is about three times the amount of carbon dioxide emitted by global aviation.

The great challenges of our time – environmental protection and the mitigation of the effects of climate change – cannot be mastered without changes in the construction industry.

The vision: establishing **a new way to build** by using C³-carbon concrete composite. Concrete will replace steel in the long term. Since carbon does not rust, most of the concrete, which is only used to protect the steel from corroding, can be spared. Carbon reinforced concrete is sustainable, environmentally friendly, saves material and weighs less. This offers a wider variety for architectural designs. *Light Building* and *concrete* are no longer a contradiction, but the concept of the future.

By 2021, all conditions should be created to introduce carbon reinforced concrete onto the market. By 2025, the construction should be established permanently.

C³ – Carbon Concrete Composite is currently the largest research project in the German construction industry. The construction industry, with a turnover of approximately 10 % of the gross domestic product and more than 330,000 companies, is the most important branch of industry in Germany. Approximately 6 % of all employees work in the building industry.

The Federal Ministry of Education and Research is funding the project as part of the initiative "Zwanzig20 – Partnerschaft für Innovation" (*Twenty20 – Partnership For Innovation*) with up to 45 million euros. All companies involved add another 15 million euros capital.

Goals

Along the entire value chain – from the basic materials to the finished building – the required knowledge must be gathered, completed by basic and applied research and transferred to the planning process, the design and the manufacture. Roughly 3,000 new jobs will be created and existing jobs will take on a new quality. The substantial quality of our buildings will increase while costs can be reduced and the resource consumption can be lowered. At the same time it has to be proved that buildings and components made of carbon reinforced concrete ensure all safety standards. This applies to all newly created buildings and components as well as for the repair and protection of existing structures e.g. bridges.

Thematic emphases

- Strategy: innovation management, development of organization and communication structures (e.g. knowledge transfer, network management, marketing, controlling)
- Structural engineering: development of testing and dimensioning concepts, standardization and development of guidelines, new planning and design concepts, quality management from raw material to product



Photo: Thilo Schoch

- Mechanical engineering: development of new fiber based reinforcement structures, development of textile machines, development of industrial scale manufacturing processes, coating technology, recycling concepts
- Chemical Engineering: Development of raw materials, semi-finished products (yarn, rods), coating agents, adapted concrete mixtures
- Electrical engineering: development of functional integration (e.g.: sensors, heating, health monitoring, data transfer)

Partners

The interdisciplinary consortium currently consists more than 160 partners. They cover all essential and necessary areas of expertise vital for the C³-project. There are various industries involved in addition to the construction industry such as chemistry, mechanical engineering, engineering, electrical engineering, and the organization and communication management. Also represented are the health, the education and the training and further education sectors. 71 % of the partners are companies, 25 % research institutions and 4 % registered associations.

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