Understanding the properties of the new generation of environmentally friendly nanocarbon-based conductive concrete: a step toward construction of the future (Carbon4Future)

Concrete, as one of the most widely used construction materials, is pivotal in shaping modern infrastructure. However, traditional concrete production is responsible for significant environmental impacts, including high carbon emissions. The Carbon4Future project aims to address these challenges by developing an innovative nanocarbon-based conductive concrete that combines superior mechanical, electrical, and environmental properties.

The focus of the project is the integration of nanocarbon materials, such as carbon nanostructured (CN), into concrete formulations. We will produce CN-based mineral powders modified electrical conductive concrete (ECC) to offer extraordinary properties, including high electrical conductivity, time stability, durability and mechanical strength. By incorporating these advanced materials, the project seeks to create a multifunctional concrete that can conduct electricity, self-monitor structural health, and enhance durability, all while reducing environmental impact. We will also investigate a social acceptance on ECC.

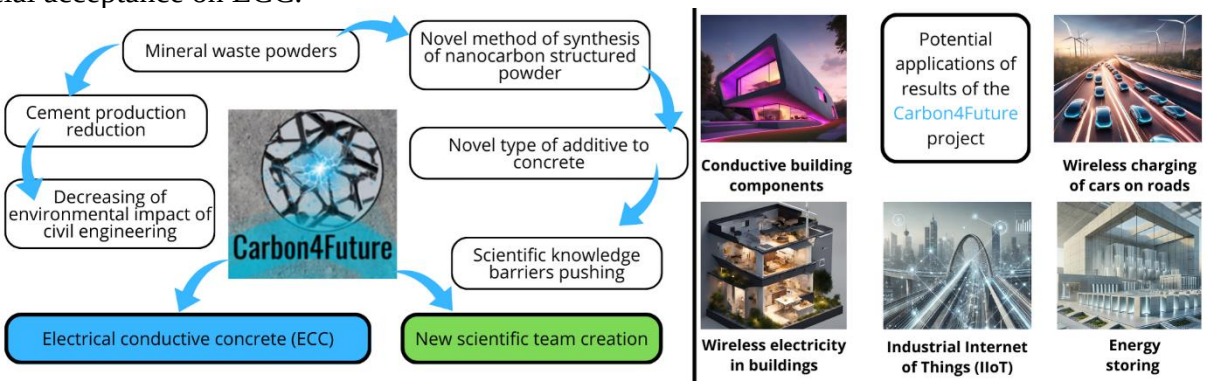

Figure 1. Basics and applications of the Carbon4Future project.

The research involves four key objectives:

1. **New type of conductive additive creation:** Based on patented technology we will create a nanocarbon structures on mineral powders grains.
2. **Material Optimization**: Developing an optimal mix design of concrete with nanocarbon additives to achieve desired properties. This includes achieving uniform dispersion of nanocarbon materials within the cement matrix to maximize performance benefits.
3. **Performance Evaluation**: Comprehensive testing of the mechanical, electrical, and chemical properties of the new concrete under various environmental conditions.
4. **Environmental and Social Impact Assessment**: Analysing the sustainability of the production process, with a focus on reducing the carbon footprint compared to traditional concrete. Life and Social cycle assessments will help ensure the material is a viable green alternative and social acceptance on using ECC in the practice.

The anticipated outcomes of Carbon4Future include advancements in sustainable construction materials, paving the way for "smart" cities and infrastructure capable of addressing global challenges like climate change and resource scarcity. The research holds promise for applications in self-heating roads, smart grids, and resilient buildings, setting the foundation for eco-friendly and technologically advanced urban development.

This project bridges the gap between materials science and construction engineering, contributing to a greener future while enhancing the functionality of construction materials. Carbon4Future is a step toward redefining the construction industry for the 21st century.