Advances in research on concrete with reduced CO_2 footprint

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The seminar will present the review of research on concrete with reduced CO_2 footprint conducted at Institute of Fundamental Technological Research of Polish Academy of Sciences (IPPT PAN) in Warsaw, Poland. The IPPT PAN is a multidisciplinary research institute active in several scientific disciplines, including materials science of concrete. Both experimental and theoretical approaches are used to investigate the fundamental problems of cement based materials, including characterization, design, optimization and diagnostics. The focus of the research which is the subject of this presentation is on developing new multicomponent cements and supplementary materials with reduced carbon footprint and prediction of their long-term performance. The major objective is to explore the relationships between the microstructure and physical and mechanical properties of these materials, with particular emphasis on their durability in aggressive environment. Digital microscopic methods and microindentation mapping were used for quantitative characterization of the microstructure. An original test method was developed for determination of thermal properties of hardening concrete using an inverse analysis approach. Selected soft computing methods, including machine learning, were used to generate rules to predict the durability of concrete. The concepts of self-healing of cracks, monitoring of cracking and optimization of fiber reinforcement in concrete are also being developed.