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Special Issue Reprint

Towards Sustainable Low-Carbon Concrete

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This Reprint brings together recent peer-reviewed studies that advance the development and application of sustainable low-carbon concrete. As the construction sector seeks to reduce greenhouse gas emissions and resource consumption, concrete technology is undergoing significant transformation. The contributions collected here explore innovative binder systems, waste-derived supplementary materials, and high-performance composite designs that enable substantial reductions in embodied carbon while maintaining or enhancing mechanical properties and durability. The Reprint covers alkali-activated and geopolymer materials, hybrid fiber-reinforced strain-hardening composites, and low-clinker cementitious systems incorporating industrial by-products and agricultural residues. Several studies investigate microstructural evolution, fracture behavior, interfacial bonding, and long-term performance, providing mechanistic understanding alongside structural validation. Applications in marine environments, seismic regions, and digitally fabricated components are also addressed, demonstrating the feasibility of using sustainable materials in demanding engineering scenarios. By integrating materials science, structural performance, and life-cycle considerations, this Reprint presents a comprehensive overview of current progress toward resilient, durable, and environmentally responsible concrete infrastructure.

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