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Geopolymer Concrete from Construction and Demolition Waste: A Sustainable Solution for Carbon Emission Reduction

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Abstract - Construction and demolition waste (CDW) has recently gained recognition as a potential raw material for geopolymer production, primarily due to its high silica and alumina content, as well as the substantial quantities generated annually. The utilization of CDW in geopolymers presents an opportunity for sustainable waste management while reducing the reliance on conventional raw materials.

This paper provides a comprehensive review of the latest advancements in the production and properties of geopolymer paste, mortar, and concrete, with a particular emphasis on geopolymers derived from CDW. It explores the main factors influencing the performance of CDW-based geopolymer concrete, including mix design and optimization strategies. Furthermore, the paper presents the most recent findings on the mechanical and durability properties of CDW-based geopolymer concrete, offering insights into their structural performance and long-term stability.

In addition to technical aspects, this review also addresses the economic and environmental impacts of incorporating recycled CDW in geopolymer concrete production, including their potential to reduce carbon emissions in the construction sector. Lastly, the paper highlights the main challenges facing the widespread commercialization of geopolymer concrete in the construction industry, discussing potential solutions and future research directions.

Keywords: CO2 emission, Construction and Demolition waste, Geopolymer concrete, Sustainability, Life cycle assessment.