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Artificial Intelligence(AI) Revolution

Challenges, Prospects and Ethical Aspects

Reviewing the Performance and Uses of Lightweight Geopolymer and Alkali-Activated Composites Incorporating Ceramic, Polymeric, and Lignocellulosic Waste as Aggregates

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Résumé

As the construction industry moves towards more sustainable practices, the use of environmentally-friendly and durable materials, ensuring the comfort of buildings and infrastructure, becomes crucial. In this context, alkali-activated binders (AAB) and geopolymers (GP) have emerged as important alternatives, with a lower carbon footprint than conventional Portland cement (OPC). In addition, the integration of lightweight waste-based aggregates with AAB and geopolymers represents an essential alternative. This combination produces lightweight composites offering improved mechanical performance and construction comfort, while helping to reduce the growing amount of waste from various sources. This paper proposes a comprehensive review of the literature concerning the use of these lightweight waste-based aggregates in AAB/GP matrices, published between 2012 and 2023, mainly indexed in the Scopus database.

The literature has catalogued lightweight waste-based aggregates, analyzing their characteristics and morphology. The impact of the size, quantity and nature of these aggregates on the properties and performance of the composite material was examined, taking into

account aspects such as workability, mechanical strength, density, as well as thermal and acoustic insulation. In addition, a bibliometric analysis was carried out to establish relationships between key terms and collaborations between researchers in this field. This study highlights the potential of cementitious composites, particularly those incorporating lightweight waste-based aggregates, as sustainable materials for both structural and non-structural applications in the construction sector. However, more research is needed to deepen our understanding of how these composites behave in innovative manufacturing processes, such as extrusion and 3D printing.

Keywords: Lightweight aggregate, Circular economy, Building materials, Alkali activation Geopolymers.