

Phosphate-Based Geopolymers: current advances and Key Challenges

H. HANNACHE^{1*}, H. MAJDOUBI¹, J. ALAMI¹

¹*Materials Science and Nanoengineering Department, Mohamed VI Polytechnic University, Benguerir, Morocco.*

*Corresponding authors: hassan.hannache@um6p.ma

Abstract

Phosphate-based geopolymers have emerged as a promising class of sustainable materials, offering significant advantages in various industries due to their unique properties such as high mechanical resistance, good chemical resistance, and excellent thermal stability. These materials, derived from phosphoric acid and industrial by-products, offer a sustainable alternative to traditional cement and concrete, contributing to reduced carbon emissions and enhanced material recycling.

This chapter will provide a comprehensive overview of recent advancements in phosphate-based geopolymer research, highlighting key areas such as novel synthesis methods, enhanced mechanical and chemical properties, and the development of eco-friendly formulations. It will also delve into the integration of phosphate industry by-products in the geopolymerization process, further emphasizing the sustainability aspect.

Moreover, the chapter will address the major challenges hindering widespread adoption, including issues related to long-term durability, scaling up production, regulatory frameworks, and the need for standardization. By analyzing these challenges, the chapter will offer insights into potential solutions and research directions that could propel phosphate-based geopolymers to the forefront of green construction technologies.

This contribution aims to serve as a valuable resource for researchers, engineers, and industry professionals working in the fields of material science, environmental engineering, and sustainable construction, offering a roadmap for future developments in this innovative domain.

Keywords: Geopolymers, Phosphate, Sustainable materials, Phosphoric Acid, Industrial by-products.