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# Editorial: Physico-mechanical properties and treatment technology of hazardous geomaterials: volume III

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Editorial on the Research Topic
Physico-mechanical properties and treatment technology of hazardous geomaterials-volume III

## Introduction

New geomaterials and technologies are involved in a wide range of applications in all areas of civil engineering, including slope stabilization, coastal engineering, landfill containment, hydraulic engineering, highway and bridge construction, underground storage facilities, post-disaster reconstruction, and tunnel support. The projects cover common materials for infrastructure construction, as well as the disposal of hazardous geomaterials, resource utilization of industrial waste, and the development of geopolymer materials and new materials for the treatment of contaminated soils related to geo-environmental engineering. Along with the increasing complexity of the external environment, newly developed geotechnical materials are associated with the coupling of several disciplines, including physics, mechanics, chemistry, and even biology. Although scholars have achieved certain research results, there is still insufficient awareness of many new materials and their performance under complex environmental conditions.

The Research Topic intends to gather the latest research results and review articles on new synthetic materials, disaster soil reinforcement, and engineering security in complex environments. A total of six articles are presented on this Research Topic, including theoretical analyses, laboratory experiments, numerical simulations, and field tests. This topic provides a significant reference for infrastructure design, stability assurance, and environmental protection in geotechnical engineering.

## Attributes and remediation methods of hazardous geomaterials

Qi et al. proposed a novel alkaline activation method by incorporating ordinary Portland cement, carbide slag, and sodium silicate as alkaline activators. Through experiments such as compressive strength tests, hydration heat analysis, pore structure analysis, X-ray diffraction, thermogravimetric analysis, and slag reaction degree testing, the effects of ordinary Portland cement, carbide slag, and sodium silicate on the hydration process and mechanical properties of super-sulfated cement were systematically investigated. The results showed that these activators can significantly enhance the early mechanical properties and microstructure of super-sulfated cement, while maintaining its environmental friendliness and low-carbon characteristics.

Zhang et al. investigated the effects of varying water content and dry density on the swelling pressure and pore structure of phyllite residual soil during saturation through experiments such as swelling pressure tests and nuclear magnetic resonance analysis. The findings provided valuable insights into the engineering properties of phyllite residual soil, which are critical for ensuring the stability of roadbeds and addressing geotechnical challenges in regions with significant rainfall.

Chun et al. studied the swelling characteristics of sand–bentonite mixtures under diesel contamination conditions. The impacts of different sand and diesel contents on the swelling time process and microstructure of the mixtures were investigated by means of no-load swelling tests, cation exchange capacity measurements, and particle size distribution analysis. The results revealed that the combined effects of sand and diesel significantly affected the swelling process, reducing the swelling coefficient and altering the pore structure. The discoveries provided valuable insights for the design and performance evaluation of landfill liners and containment materials in contaminated environments.

Dun et al. focused on the numerical simulation analysis of the stability of the construction face of an extra-long tunnel, particularly under conditions of precipitation and abundant groundwater. A numerical method was used to discuss the influence of different water levels on the stress, displacement, and seepage of the tunnel-surrounding rock. The research results offered valuable guidance for improving the safety and stability of tunnel construction under complex hydrogeological conditions.

Yao et al. developed a nonlinear regression model to predict the swelling characteristics of cracked expansive soils by considering factors such as crack rate, dry density, initial moisture content, and applied load. Through the combination of field investigations, laboratory tests, and theoretical modeling, the study examined how these factors influence the swelling behavior of expansive soils, particularly focusing on the role of cracks. The developed model provided a more accurate prediction of swelling rates, offering valuable insights for infrastructure design and maintenance in areas with expansive soils.

Wang et al. conducted disintegration tests to observe the disintegration rate of red clay in solutions with different pH values by a self-made disintegration apparatus. An inductively coupled plasma mass spectrometer and Zeta potential analyzer were used to test the concentration of the cations in the solutions and the electric potential of red clay, analyzing the effect of pH on the physicochemical properties and the disintegration rate of red clay, providing a scientific basis for evaluating and preventing soil caves collapse.

## Conclusion

Submissions for this Research Topic have been closed. We look forward to the development of more extensive and in-depth research in the field of hazardous geomaterials and engineering environments. In the future, studies on hazardous geomaterials will be gradually developed in the direction of more intelligent, sustainable, and multidisciplinary integration driven by advanced technology and environmental awareness. All of the selected contributions help reveal innovative concepts and cutting-edge technologies in this broad field. The editors would like to thank all reviewers and authors for their highly effective contributions.

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BB: conceptualization, funding acquisition, writing–original draft, and writing–review and editing. RA–R: writing–review and editing. RT: writing–review and editing.

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