



OPEN ACCESS

EDITED AND REVIEWED BY

John L. Provis,
Paul Scherrer Institut (PSI), Switzerland

*CORRESPONDENCE

Hui Yao,
✉ huiyao@mtu.edu

RECEIVED 17 September 2023

ACCEPTED 19 September 2023

PUBLISHED 25 September 2023

CITATION

Yao H, Wang D, Dai Q and Oeser M (2023), Editorial: Multiscale characterization of advanced pavement materials. *Front. Mater.* 10:1295653. doi: 10.3389/fmats.2023.1295653

COPYRIGHT

© 2023 Yao, Wang, Dai and Oeser. This is an open-access article distributed under the terms of the [Creative Commons Attribution License \(CC BY\)](https://creativecommons.org/licenses/by/4.0/). The use, distribution or reproduction in other forums is permitted, provided the original author(s) and the copyright owner(s) are credited and that the original publication in this journal is cited, in accordance with accepted academic practice. No use, distribution or reproduction is permitted which does not comply with these terms.

Editorial: Multiscale characterization of advanced pavement materials

Hui Yao^{1*}, Dawei Wang^{2,3}, Qingli Dai⁴ and Markus Oeser²

¹Faculty of Architecture, Civil and Transportation Engineering, Beijing University of Technology, Beijing, China, ²Institute of Highway Engineering, RWTH Aachen University, Aachen, Germany, ³School of Transportation Science and Engineering, Harbin Institute of Technology, Harbin, China, ⁴Civil, Environmental, and Geospatial Engineering, Michigan Technological University, Houghton, MI, United States

KEYWORDS

civil engineering, pavement materials, pavement performance, characterization method, technical optimization method

Editorial on the Research Topic

Multiscale characterization of advanced pavement materials

The improvement of pavement materials and performance has always been a main direction for researchers. Whether the road performance of pavement materials is fine or not produces a decisive influence on service life and driving comfort of pavement. Therefore, the exploration and innovation of pavement materials and technologies are extremely important to enhance pavement performance in engineering construction.

“Frontiers in Materials” is a very highly renowned international journal, which publishes rigorously peer-reviewed research in the fields of materials science and engineering. This Research Topic “*Multiscale Characterization of Advanced Pavement Materials*” reports the emerging technologies in the field of pavement engineering that have been developing. This special Research Topic concentrates on the following aspects: advanced pavement materials, advanced road performance characterization methods, and technical optimization methods.

- 1) Advanced Pavement Materials: The Redundant wind turbine blades (WTBs) powders and fibers were prepared and added to the asphalt mixture to prepare WTBs asphalt concrete. The road performance of WTBs asphalt concrete was investigated by wheel tracking tests, three-point bending tests, and Marshall immersion tests. The results showed that the synergistic effect of WTBs powders and fibers could comprehensively improve the road performance of asphalt concrete (Lan et al.). The effects of different chloride deicing agents on the performance of asphalt and mixture were also completely researched. The three deicing agents (NaCl, KHF-1A, and NW056) were selected, and their influence on the performance of asphalt and asphalt mixture through the DSR test, BBR test, indirect tensile test, the bending test of the small beam and freeze-thaw splitting test were examined. The results indicated that the NW056 deicing agent had minimal effect on the performance of airport pavement, which could replace traditional chloride deicing agents to extend the service life of airport asphalt pavement (Li et al.).
- 2) Advanced road performance characterization methods: The high-temperature properties of rubberized asphalt and mixture were evaluated by a series of laboratory experiments, including frequency scanning, repeated creep recovery test, temperature sweep test, and Hamburg wheel tracking test. The evaluation indexes of the high-temperature properties

of rubberized asphalt and mixture were analyzed through the gray correlation theory (Xie et al.). Recently, the bibliometric analysis method was conducted to study the effects of physical and chemical properties of polymer and matrix asphalt on the road performance of polymer-modified asphalt (Alnadish et al.). In addition, in order to reveal the damage mechanism of cement concrete pavement by weakened subgrade modulus, a meshless finite block method was invented, and a normal distribution function was used to study the distribution of subgrade modulus at the bottom of cement concrete pavement panel (Wei et al.). Based on the traffic data of a steel deck strengthened with the ultra-high-performance concrete (UHPC) layer for 1 week, the Monte Carlo method was used to simulate the fatigue life of the bridge deck under random traffic loads, a fatigue life analysis model including traffic load simulation, a refined finite element model, the S-N curve and Miner linear cumulative damage criterion had been established to predict the service life of bridge deck (Deng and Yi). The changes in capillary water absorption and pore distribution would lead to a decrease in the durability of steam-cured concrete, reducing the bonding performance between concrete and GFRP bars. The method of steam curing was used to simulate the damage of the actual steam curing environment to components. The influence of pore characteristics on the bonding performance between steam-cured concrete and GFRP steel bars was deliberated through SEM, mercury intrusion test, and three-point beam test (Zhang et al.).

- 3) Technical optimization methods: In order to diminish the destructive rate of the pavement and extend the service life of the road, fog seal technology has been widely applied in pavement maintenance. However, based on the deficiency of the existing fog seal test methods, the road performance of different types of fog seals was measured through improved Wet Track Abrasion Test (WTAT), improved Cantabro test, improved Water seepage test, and improved Pendulum instrument tester pavement friction coefficient test (Li et al.). The grafting-activated crumb rubber (GACR) was incorporated into the terminal blend rubber asphalt (TB) to prepare the terminal blend/grafting activated crumb rubber composite modified asphalt, the response surface methodology was used to investigate the effects of shear temperature, shear time, and grafting active rubber powders content on the performance of composite modified asphalt so as to optimize the preparation process of composite modified asphalt. The experiment results

showed that the composite-modified asphalt had good high-temperature stability and storage stability under the conditions of a shearing temperature of 190°C, shearing time of 90 min, and GACR content of 15% (Xie et al.).

Nine manuscripts were invited and received as possible publications in the Research Topic. All manuscripts were rigorously, fairly, and anonymously reviewed. Both the quality and originality of these papers were thoroughly examined and checked. Finally, nine research articles were accepted and approved for publication.

Author contributions

HY: Conceptualization, Writing–original draft, Writing–review and editing. DW: Conceptualization, Writing–original draft, Writing–review and editing. QD: Conceptualization, Writing–review and editing. MO: Conceptualization, Writing–review and editing.

Acknowledgments

Our editorial team members thank all reviewers for their professional and dedicated support and help, and also, appreciate all the authors for their efforts and contributions to this Research Topic. In addition, we all are grateful to the editorial and support teams from Frontiers in Materials, especially Prof. John L. Provis, Elie Abdel Ahad, and Tanya Grenade.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.