

Curriculum Vitae

MA, Hongyan Ph.D.

Francisco Benavides Scholar and Associate Professor
Dept. of Civil, Architectural and Environmental Engineering
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Education Background:

2008/09 – 2013/02 **Ph.D.** in Civil Engineering

The Hong Kong University of Science and Technology, Hong Kong ASR.

Thesis: Multi-Scale Modeling of the Microstructure and Transport Properties of Contemporary Concrete (Advisor: Prof. Zongjin Li)

2005/09 – 2008/06 **M.Eng.** in Structural Engineering

Shenzhen University, Shenzhen, China.

Thesis: Influence of Sea Sand on Hydration and Rebar Protection Property of Cement-Based Materials (Advisor: Prof. Feng Xing)

2003/09 – 2005/06 **B.Law**

Law School, Chongqing University, Chongqing, China.

2001/09 – 2005/06 **B.Eng.** in Inorganic Non-metallic Materials Engineering

Chongqing University, Chongqing, China.

Work Experience:

2022/12 – Francisco Benavides Scholar, Department of Civil, Architectural and Environmental Engineering, Missouri S&T.

2021/09 – Associate Professor, Department of Civil, Architectural and Environmental Engineering, Missouri S&T.

2015/10 – 2021/08 Assistant Professor, Department of Civil, Architectural and Environmental Engineering, Missouri S&T.

2013/03 – 2015/10 Post-doctoral Fellow (functional composites for energy storage), Department of Civil and Environmental Engineering, HKUST.

Recent Awards, Honors and Recognitions:

- Francisco Benavides Scholar (mid-career endowed position), December 2022.

- Faculty Research Award, Missouri S&T (based on 2-year performance regarding research), December 2022.
- Game Changer Academies Panel Fellow, CMMI, NSF, May 2022.
- Outstanding Teaching Award, Missouri S&T, December 2021.
- Faculty Excellence Award, Missouri S&T (five/year, based on 5-year performance regarding research, teaching and service), December 2020.
- **Top 2% Scientists** of “Building & Construction”, according to science-wide Composite Citation Indicator¹, 2020 (Career rank=394; Single year rank=136); 2021 (Career rank=291; Single year rank=118); 2022 (Career rank=268; Single year rank=107).
- Faculty Research Award, Missouri S&T (seven/year, based on 2-year performance regarding research), December 2019.
- College of Engineering and Computing Dean’s Scholar, Missouri S&T, October 2019.
- Joseph H. Senne Jr. Academy of Civil Engineers Faculty Scholarly Achievement Award, April 2019.
- ExCEEEd Fellow, American Society of Civil Engineers, June 2017.

Research Interests:

- Future cements
 - Cement efficiency enhancing strategies
 - Novel supplementary cementitious materials
 - Alternative (high-performance niche and carbon-negative) Cements
- Solid waste upcycling;
- Thermal energy storage and micro-grid integration;
- Massive CO₂ capture, utilization and storage.
- Compositional and microstructural characterizations;
- Multi-scale modeling (from molecular dynamics to macroscopic FEM);
- Mechanisms and mitigation of concrete deterioration;
- Acoustics- and optics-based NDTs and sensing;
- Nano- and biological technologies in construction;
- Recovery of critical minerals from lean ores.

Funded Research Projects:

Externally Funded

- [34] “Converting CO₂ and Alkaline Solid Wastes to Carbon-Negative Alternative Cement for Precast Concrete Units”, *Department of Energy*, sub-awarded from Washington University in St. Louis. \$925,000 (Ma as PI), *negotiating*.
- [33] “Concrete Assisted by Particles Sealed Under Large-scale Encapsulation (CAPSULE)”, funded by *Defense Advanced Research Projects Agency (DARPA)*, sub-awarded from Lawrence Livermore National Laboratory (LLNL),

¹ <https://doi.org/10.1371/journal.pbio.3000918> (or [database](#))

- 02/2023-08/2027, \$1,460,000 (Ma as PI); Co-PIs: Jie Huang, Kamal Khayat.
- [32] “Reduce Comminution Energy and Improve Energy Relevant Mineral Yield using Carbon-Negative Reactions”, funded by DOE’s *Advanced Research Projects Agency–Energy* (#DE-AR0001707), 01/24/2023-01/23/2026, \$2,045,715 (Ma as PI); Co-PIs: Lana Alagha, Kwame Awuah-Offei, Andreas Eckert, Zhenghua Li, Marek Locmelis, and Michael Moats.
- [31] “ECO-CBET: GOALI: CAS-Climate: Expediting Decarbonization of Cement Industry through Integration of CO₂ Capture and Conversion”, funded by *National Science Foundation* (#2219086), 01/01/2023-12/31/2026, \$1,695,614 (Ma: \$678,246); Other Co-PIs: Fateme Rezaei (PI), Kwame Awuah-Offei, Joseph Smith, and Chengqing Qi.
- [30] “NSF Convergence Accelerator Track I: Revolutionizing the manufacture of Portland cement concretes towards a circular and carbon-negative future”, funded by *National Science Foundation* (#2236331), 12/15/2022-11/30/2023, \$75,000, Site PI.
- [29] “Low Carbon binder Technology ACT and Concrete: R&D towards indigenous raw materials adaptation and mixture proportion optimization”, funded by *Ecocem Materials Ltd.*, 12/01/2022-11/30/2024, \$400,000 (Ma: \$120,000); Co-PIs: Kamal Khayat (PI), Monday Okoronkwo.
- [28] “CO₂ Capture Using Steel Slag and Utilization of the Product as a High-Value Cementitious Material”, funded by *Association for Iron & Steel Technology (AIST) Foundation*, inaugural Sustainable Technologies for Steel Manufacturing Grant (STSM), 09/01/2022-05/31/2023, \$30,000 (Ma: \$21,000); Co-PI: Ronald O’Malley.
- [27] “PFI-TT: Decarbonizing concrete using carbon-negatively processed solid waste”, funded by *National Science Foundation* (#2214028), 7/15/2022-6/30/2024, \$250,000 (Ma: \$212,500); Co-PI: Mahelet Fikru.
- [26] “Hyperspectral Imaging and Analysis for Steel Paint Condition Assessment”, funded by *US Department of Transportation* under the Auspices of *INSPIRE University Transportation Center* at Missouri S&T, 07/01/2022-06/30/2023, \$108,821 (Ma: \$54,411); Co-PI: Genda Chen.
- [25] “Converting Off-Specification Coal Ash and Incinerator Ash into High-Value Blended Cementitious Materials through Enhanced CO₂ Uptake”, funded by *Environment Research and Education Foundation*, 01/18/2022-01/17/2024, \$150,000 (Ma: \$105,000); Co-PI: Aditya Kumar.
- [24] “I-Corps: Carbon-Negative Supplementary Cementitious Materials for Carbon-Neutral Concrete”, funded by *National Science Foundation* (#2140296), 08/01/2021-1/31/2023, \$50,000; Sole PI.
- [23] “Exploring the Potential of MSWI Ash in Construction Materials”, funded by *York County Solid Waste & Refuse Authority*, 01/01/2021-11/30/2021, \$13,000; Sole PI.
- [22] “MRI: Acquisition of High-Resolution X-Ray Computed Tomography System for Real-Time, In Situ Studies of Various Effects on Microstructure of Materials”, funded by *National Science Foundation* (#2018768), 10/01/2020-09/30/2021,

\$918,397 (Ma: \$220,415); Other Co-PIs: Monday Okoronkwo (PI), Aditya Kumar, Richard Brow, and Ronald O'Malley.

- [21] “Health Inspection of Concrete Pavement and Bridge Members Exposed to Freeze-Thaw Service Environments”, funded by *US Department of Transportation* under the Auspices of *INSPIRE University Transportation Center* at Missouri S&T (#0062134), 01/01/2020-06/30/2023, \$202,632 (Ma: \$101,316); Co-PI: Genda Chen.
- [20] “Sustainable and Durable Calcium Sulfoaluminate Binders Enabled by Multi-Physics Characterization and Theory-Guided Machine Learning”, funded by *National Science Foundation* (#1932690), 09/01/2019- 08/31/2023, \$532,000 (Ma: \$133,000); Other Co-PIs: Monday Okoronkwo (PI), Aditya Kumar, and Jie Huang.
- [19] “GAANN: Preparing Interdisciplinary Professionals for Rebuilding/Engineering Resilient Infrastructure of the Nation”, funded by *US Department of Education*, 10/01/2018-9/30/2023, \$651,174 (Ma: \$32,559); Other Co-PIs: Magdy Abdelrahman (PI), Jenny Liu, Xiong Zhang, Joel Burken, John Myers, and Xianbiao Hu.
- [18] “Collaborative Research: In-situ Production of Calcium Carbonate Nanoparticles in Fresh Concrete”, funded by *National Science Foundation* (#1761697), 08/15/2018-07/31/2023, \$199,422; Sole PI.
- [17] “A Thermo-Kinetic Approach to Enhance the Use of Clays in Concrete”, funded by *National Science Foundation* (#1661609), 07/01/2017-06/30/2022, \$425,948 (Ma: \$191,677); Other Co-PI(s): Aditya Kumar (PI).
- [16] “INSPIRE: Hyperspectral Image Analysis for Mechanical and Chemical Properties of Concrete and Steel Surfaces”, funded by *US Department of Transportation* under the Auspices of *INSPIRE University Transportation Center* at Missouri S&T, 03/01/2017-12/31/2019, \$219,273 (Ma: \$109,637); Other Co-PI(s): Genda Chen (PI).
- [15] “Inspecting and Preserving Infrastructure through Robotic Exploration (INSPIRE) – a Tier 1 University Transportation Center”, funded by *US Department of Transportation*, Office of the Assistant Secretary for Research and Technology (USDOT/OST-R) (#69A3551747126), 11/30/2016-09/30/2022, \$8,468,200 (Ma: \$169,364); Other Co-PIs: Genda Chen (PI), Suzanna Long, Ruwen Qin, John Myers, Lesley Sneed, Mohamed ElGawady, Zhaozheng Yin, and Reza Zoughi.
- [14] “Blended cementitious materials for concrete: quantitative characterization of the hydration kinetics and computer simulation of the microstructure”, funded by *National Natural Science Foundation of China* (#51408365), 01/01/2015-12/31/2017, CNY 250,000; Sole PI.
- [13] “High performance magnesium phosphate cement based bipolar plate for fuel cell”, funded by *Hong Kong Innovation and Technology Fund* (#ITP/033/12NP), 03/2013-08/2015, HK\$4,100,000 (Ma as deputy PI: HK\$1,435,000); Other Co-PIs: Zongjin Li (PI), and Wenbin Hao.

Internally Funded: within University of Missouri System

- [12] “Planning an ERC and Other Significant Projects on Gigaton-Scale Carbon-Negative Engineering”, funded by the *Ignition Grant Initiative* (IGI), 11/11/2022-06/30/2023, \$32,000.
- [11] “Upcycling solid wastes into value-added construction materials using carbonation”, funded by *G2G program*, 06/24/2021-06/30/2022, \$47,571; Sole PI.
- [10] “Exploring Compact-Hardening Capacity of Aluminosilicate Hydrate Gels”, funded by the *Materials Research Center* seed funding program at Missouri S&T, 11/01/2020-06/30/2021, \$18,765; Other Co-PI(s): Aditya Kumar.
- [9] “The Center for Novel Carbon-Efficient Binders for Sustainable Infrastructure”, funded by UM system’s *Strategic Investment Program for Research and Creative Works*, \$125,000; Other Co-PIs: Kamal Khayat (PI), Sajal Das, Aditya Kumar, and George A. Zsidisin.
- [8] “Integrated Thermal Harvesting and Ground Storage for Thermally Active Building Systems Using Phase Change Materials”, funded by the *Advanced Materials for Sustainable Infrastructure* Signature Area at Missouri S&T, 11/01/2018-07/31/2019, \$9,641; Other Co-PI(s): Guney Olgun (PI).
- [7] “Properties of Concrete Modified by In-Situ Formed Calcium Carbonate Nanoparticles”, funded by the *Advanced Materials for Sustainable Infrastructure* Signature Area at Missouri S&T, 11/01/2018-07/31/2019, \$9,641; Other Co-PI(s): Kamal Khayat.
- [6] “Improving the Sustainability and Performance of Calcium Sulfoaluminate Binders through Optimization of Composition, Reactivity, and Microstructure”, funded by the *Advanced Materials for Sustainable Infrastructure* Signature Area at Missouri S&T, 11/01/2018-07/31/2019, \$9,641; Other Co-PI(s): Aditya Kumar (PI).
- [5] “Off-Specification Fly Ash Incorporated Magnesium Phosphate Cement as a Sustainable Binder”, funded by the *Advanced Materials for Sustainable Infrastructure* Signature Area at Missouri S&T, 01/01/2018-12/31/2018, \$15,676; Other Co-PI(s): Aditya Kumar and Kamal Khayat.
- [4] “Comprehend Sulfate Attack in Concrete using In-Situ Fiber-Optic Sensors”, funded by the *Advanced Materials for Sustainable Infrastructure* Signature Area at Missouri S&T, 01/01/2018-12/31/2018, \$15,676; Other Co-PI(s): Jie Huang (PI).
- [3] “A Multi-Physics Approach to Characterize Freeze-Thaw Damage of Concrete”, funded by the *Advanced Materials for Sustainable Infrastructure* Signature Area at Missouri S&T, 01/01/2018-12/31/2018, \$15,676; Other Co-PI(s): Kristen Donnell (PI).
- [2] “Mitigating Thermal Cracking of Concrete using Phase Change Materials”, funded by the *Advanced Materials for Sustainable Infrastructure* Signature Area at Missouri S&T, 06/01/2017-05/31/2018, \$15,732; Other Co-PI(s): Kamal Khayat and Aditya Kumar.
- [1] “Development of Flexible Nanostructured Cementitious Composite using Polymer Aerogels”, funded by the *Advanced Materials for Sustainable Infrastructure* Signature Area at Missouri S&T, 06/01/2017-05/31/2018, \$15,732; Other Co-PI(s):

Chenglin Wu (PI) and Charles Wojnar.

Publications:

Books and Book Chapters

- [3] Jin, Q., **Ma, H.** (2023). Nano TiO₂-engineered cementitious materials with self-cleaning properties; in *Nanotechnology for Civil Infrastructure: Innovation and Eco-efficiency of Nanostructured Cement-Based Materials* (edited by Khayat, K. and Meng, W.). Elsevier Science; ISBN-13: 9780128178324.
- [2] Li, Z., Zhou, X., **Ma, H.**, Hou, D. (2022). *Advanced Concrete Technology, 2nd Edition*. Hoboken: Wiley. ISBN: [978-1-119-80625-7](#) (print); [978-1-119-80619-6](#) (e-book).
- [1] Hou, D., **Ma, H.**, Zhang, J., ed. (2022). *Molecular Simulation on Cementitious Materials: From Computational Chemistry Method to Application*. Lausanne: Frontiers Media SA. ISSN: 1664-8714. doi: [10.3389/978-2-88974-302-5](#)

Refereed Journal Articles (* denotes that I am a corresponding author)

- [113] Zhang, F., Myers, J., Liao, W., Hui, C., and **Ma, H.** (2023). Investigation of corrosion mechanism of ribbed mild steel bars coated with magnesium potassium phosphate cement paste. *Construction and Building Materials*, 71, 130639. doi: [10.1016/j.conbuildmat.2023.130639](#)
- [112] Mondal, S., Clinton, C., **Ma, H.**, Kumar, A., Okoronkwo, M. (2023). Effect of class C and class F fly ash on early-age and mature-age properties of calcium sulfoaluminate cement paste. *Sustainability*, 15(3),2501. doi: [10.3390/su15032501](#)
- [111] Zhang, J., Kang, Z., Yang, Y., Dong, B., and **Ma, H.** (2023). Enhancement of heat-cured cement paste with tannic acid. *Cement and Concrete Composites*, 137, 104931. doi: <https://doi.org/10.1016/j.cemconcomp.2023.104931>
- [110] Han, T., Bhat, R., Ponduru, S., Sarkar, A., Huang, J., Sant, G., **Ma, H.**, Neithalath, N., and Kumar, A. (2023). Deep learning to predict the hydration and performance of fly ash-containing cementitious binders. *Cement and Concrete Research*, 165, 107093. doi: [10.1016/j.cemconres.2023.107093](#)
- [109] Fang, Y., Wang, J., Wang, L., Qian, X., Wang, X., Liao, W., Chen, P., and **Ma, H.** (2023). Densifying hydration products of alite by a bio-inspired admixture. *Materials & Design*, 225, 111490. doi: [10.1016/j.matdes.2022.111490](#)
- [108] Ma, Y., Luo, Y., **Ma, H.**, Zhou, X., Luo, Z. (2022). Upcycling steel slag in producing eco-efficient iron-calcium phosphate cement. *Journal of Cleaner Production*, 371, 133688. doi: [10.1016/j.jclepro.2022.133688](#)
- [107] Luo, Y., Zhou, X., Luo, Z., **Ma, H.**, Wei, Y., Liu, Q. (2022). A novel iron phosphate cement derived from copper smelting slag and its early age hydration mechanism. *Cement and Concrete Composites*, 133, 104653. doi: [10.1016/j.cemconcomp.2022.104653](#)
- [106] Oh, K., **Ma, H.**, Yi, H., Kou, R., Vollero, D., Schmidenberg, D., Qiao, Y. (2022). Structural parts based on Municipal-Solid-Waste incineration ashes. *Waste Management*, 150, 185-190. doi: [10.1016/j.wasman.2022.07.004](#)

- [105] Lu, H., Sun, X., **Ma, H.*** (2022). Anti-washout Concrete: An Overview. *Construction and Building Materials*, 344, 128151.
doi: [10.1016/j.conbuildmat.2022.128151](https://doi.org/10.1016/j.conbuildmat.2022.128151)
- [104] Zhao, Y., Zhang, J., Qiao, G., Hou, D., Dong, B., **Ma, H.** (2022). Enhancement of Cement Paste with Carboxylated Carbon Nanotubes and Poly(vinyl alcohol). *ACS Applied Nano Materials*, 5, 5, 6877-6889. doi: [10.1021/acsanm.2c00875](https://doi.org/10.1021/acsanm.2c00875)
- [103] Lapeyre, J., Ponduru, S., Okoronkwo, M., **Ma, H.**, Kumar, A. (2022). Hydration of high-alumina calcium aluminate cements with carbonate and sulfate additives. *Journal of Thermal Analysis and Calorimetry*, 147, 5575-5587.
doi: [10.1007/s10973-021-10939-4](https://doi.org/10.1007/s10973-021-10939-4)
- [102] Yan, C., **Ma, H.**, Luo, Z., Zhou, X., Wang, L. (2022). Influence of phosphorus Sources on the compressive strength and microstructure of ferronickel slag-based magnesium phosphate cement. *Materials*, 15(5), 1965. doi: [10.3390/ma15051965](https://doi.org/10.3390/ma15051965)
- [101] Zhang, J., Kang, Z., Hou, D., Dong, B., **Ma, H.*** (2022). Wavelet power and Shannon entropy applied to acoustic emission signals for corrosion detection and evaluation of reinforced concrete. *ES Materials and Manufacturing*, 16, 46-55.
doi: [10.30919/esmm5f554](https://doi.org/10.30919/esmm5f554)
- [100] Zhang, J., Zhang, M., Dong, B., **Ma, H.** (2022). Quantitative evaluation of steel corrosion induced deterioration in rubber concrete by integrating ultrasonic testing, machine learning and mesoscale simulation. *Cement and Concrete Composites*, 128, 104426. doi: [10.1016/j.cemconcomp.2022.104426](https://doi.org/10.1016/j.cemconcomp.2022.104426)
- [99] Qin, J., Dai, F., **Ma, H.**, Dai, X., Li, Zhen, Jia, X., Qian, J. (2022). Development and characterization of magnesium phosphate cement based ultra-high performance concrete. *Composites Part B: Engineering*, 234, 109694.
doi: [10.1016/j.compositesb.2022.109694](https://doi.org/10.1016/j.compositesb.2022.109694)
- [98] Bate, B., Chen, X., Chen, C., **Ma, H.**, Zhu, J., Cao, J., Chen, J., Khayat, K., Zhang, S. (2022). Setting Times of Early-Age Mortars Determined from Evolution Curves of Poisson's Ratio. *MDPI Materials*, 15(3), 853.
doi: [10.3390/ma15030853](https://doi.org/10.3390/ma15030853)
- [97] Yu, J., Hou, D., **Ma, H.**, Wang, P. (2022). Nano-modified cement-based materials: Review (2015-2020) of molecular dynamics studies. *ASCE Journal of Materials in Civil Engineering*, 34(3), 03121002.
doi: [10.1061/\(ASCE\)MT.1943-5533.0004056](https://doi.org/10.1061/(ASCE)MT.1943-5533.0004056)
- [96] Wang, M., Zhang, K., Ji, X., Wang, P., **Ma, H.**, Zhang, J., Hou, D. (2022). Molecular insight into the fluidity of cement pastes: Nano-boundary lubrication of cementitious materials. *Construction and Building Materials*, 316, 125800.
doi: [10.1016/j.conbuildmat.2021.125800](https://doi.org/10.1016/j.conbuildmat.2021.125800)
- [95] **Ma, H.***, Hou, D., Zhang, J. (2021). Editorial: Molecular Simulation on Cementitious Materials: From Computational Chemistry Method to Application (*Peer-reviewed Article*). *Frontiers in Materials*, 8, 810850.
doi: [10.3389/fmats.2021.810850](https://doi.org/10.3389/fmats.2021.810850)
- [94] Zhang, W., Hou, D., **Ma, H.** (2021). Multi-scale study on water and ions transport in cement-based materials: from molecular dynamics to random walk. *Microporous and Mesoporous Materials*, 325, 111330.

- doi: [10.1016/j.micromeso.2021.111330](https://doi.org/10.1016/j.micromeso.2021.111330)
- [93] Cook, R., Han, T., Childers, A. Ryckman, C., Khayat, K., **Ma, H.**, Huang, J., Kumar, A. (2021). Machine learning for high-fidelity prediction of cement hydration kinetics in blended systems. *Materials & Design*, 208, 109920.
doi: [10.1016/j.matdes.2021.109920](https://doi.org/10.1016/j.matdes.2021.109920)
- [92] Sun, X., Liao, W., Kumar, A., Khayat, K., Tian, Z., **Ma, H.*** (2021). Multi-level modeling of thermal behavior of phase change material incorporated lightweight aggregate and concrete. *Cement and Concrete Composites*, 122, 104131.
doi: [10.1016/j.cemconcomp.2021.104131](https://doi.org/10.1016/j.cemconcomp.2021.104131)
- [91] Mondal, S., Welz, A., Rownaghi, A., Wang, B., **Ma, H.**, Rezaei, F., Kumar, A., Okoronkwo, M. (2021). Investigating the microstructure of high-calcium fly ash-based alkali-activated material for aqueous Zn sorption. *Environmental Research*, 198, 110484. doi: [10.1016/j.envres.2020.110484](https://doi.org/10.1016/j.envres.2020.110484)
- [90] Liao, W., Zeng, C., Zhuang, Y., **Ma, H.***, Deng, W., Huang, J. (2021). Application of Phase Change Materials in Curling Control of Concrete Pavement Slab: A Feasibility Study. *Cement and Concrete Composites*, 120, 104021.
doi: [10.1016/j.cemconcomp.2021.104021](https://doi.org/10.1016/j.cemconcomp.2021.104021)
- [89] Khanjani, M., Westenberg, D., Kumar, A., **Ma, H.*** (2021). Tuning Polymorphs and Morphology of Microbially Induced Calcium Carbonate: Controlling Factors and Underlying Mechanisms. *ACS Omega*, 6 (18), 11988-12003.
doi: [10.1021/acsomega.1c00559](https://doi.org/10.1021/acsomega.1c00559)
- [88] Qin, J., Qian, J., Dai, X., You, C., **Ma, H.**, Li, Z. (2021). Effect of water content on microstructure and properties of magnesium potassium phosphate cement pastes with different magnesia-to-phosphate ratios. *Journal of the American Ceramic Society*, 104(6), 2799-2819. doi: [10.1111/jace.17695](https://doi.org/10.1111/jace.17695)
- [87] Cook, R., **Ma, H.**, Okoronkwo, M., Sant, G., Kumar, A. (2021). Influence of water activity on belite (β -C₂S) hydration. *Journal of the American Ceramic Society*, 104(4), 1513-1525. doi: [10.1111/jace.17608](https://doi.org/10.1111/jace.17608)
- [86] Lapeyre, J., Han, T., Wiles, B., **Ma, H.**, Huang, J., Sant, G., Kumar, A. (2021). Machine learning enables prompt prediction of hydration kinetics of multicomponent cementitious systems. *Scientific Reports*, 11, 3922.
doi: [10.1038/s41598-021-83582-6](https://doi.org/10.1038/s41598-021-83582-6)
- [85] Cai, R., Yu, M., Yang, L., **Ma, H.*** (2021). Influence of data acquisition and processing on surface chloride concentration of marine concrete. *Construction and Building Materials*, 273, 121705. doi: [10.1016/j.conbuildmat.2020.121705](https://doi.org/10.1016/j.conbuildmat.2020.121705)
- [84] Okoronkwo, M., Mondal, S., Wang, B., **Ma, H.**, Kumar, A. (2021). Formation and stability of gismondine-type zeolite in cementitious systems. *Journal of the American Ceramic Society*, 104(3), 1513-1525. doi: [10.1111/jace.17572](https://doi.org/10.1111/jace.17572)
- [83] Luo, Z., Ma, Y., He, H., Mu, W., Zhou, X., Liao, W., **Ma, H.*** (2021). Preparation and Characterization of Ferrous Oxalate Cement – A Novel Acid-Base Cement. *Journal of the American Ceramic Society*, 104(2), 1120-1131.
doi: [10.1111/jace.17511](https://doi.org/10.1111/jace.17511).

- [82] Xie, J., Kou, S., **Ma, H.**, Long, W., Wang, Y., Ye, T. (2021). Advances on properties of fiber reinforced recycled aggregate concrete: Experiments and models. *Construction and Building Materials*, 277, 122345. doi: [10.1016/j.conbuildmat.2021.122345](https://doi.org/10.1016/j.conbuildmat.2021.122345)
- [81] Han, Q., Yang, Y., Zhang, J., Yu, J., Hou, D., Dong, B., **Ma, H.** (2020). Insights into the interfacial strengthening mechanism of waste rubber/cement paste using polyvinyl alcohol: Experimental and molecular dynamics study. *Cement and Concrete Composites*, 114, 103791. doi: [10.1016/j.cemconcomp.2020.103791](https://doi.org/10.1016/j.cemconcomp.2020.103791)
- [80] Cai, R., Hu, Y., Yu, M., Liao, W., Yang, L., Kumar, A., **Ma, H.*** (2020). Skin effect of chloride ingress in marine concrete: A review on the convection zone. *Construction and Building Materials*, 262, 120566. doi: [10.1016/j.conbuildmat.2020.120566](https://doi.org/10.1016/j.conbuildmat.2020.120566)
- [79] Zhang, P., Liao, W., Zhang, Q., Kumar, A., **Ma, H.*** (2020). Characterization of Sugarcane Bagasse Ash as a Potential Supplementary Cementitious Material: Comparison with Coal Combustion Fly Ash. *Journal of Cleaner Production*, 277, 123834. doi: [10.1016/j.jclepro.2020.123834](https://doi.org/10.1016/j.jclepro.2020.123834)
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Conference Publications

- [17] Zhang, W., Liao, W., Eckert, A., **Ma, H.**, Prevallet, A., Goedde, T., Wronkiewicz, D., and Meng, M. (2022). Wellbore Integrity Evaluation for CO₂ Sequestration Wells: An Integrated Experimental, Geochemical, and Numerical Investigation. 56th U.S. Rock Mechanics/Geomechanics Symposium, Santa Fe, New Mexico, USA, June 26-29, 2022. doi: [10.56952/ARMA-2022-0816](https://doi.org/10.56952/ARMA-2022-0816).
- [16] Zhang, W., Eckert, A., Ma, H. (2021). Integrated experimental and numerical evaluation for wellbore integrity of wells under downhole conditions. 55th U.S. Rock Mechanics/Geomechanics Symposium, vol. 3, pp. 755-764; Houston, Virtual, June 18-25, 2021. Paper ID: [ARMA-2021-1694](https://doi.org/10.56952/ARMA-2021-1694).
- [15] **Ma, H.** (2020). Fiber Optic Sensors Enabled Monitoring of Thermal Curling of Rigid Pavement Slab: Temperature, Strain and Inclination. IACIP Annual Workshop, Transportation Research Board 99th Annual Meeting, Washington D.C., U.S., January 12-16, 2020. [[Presentation only](#)]
- [14] Han, T., Khayat, K., **Ma, H.**, Huang, J., & Kumar, A. (2019). Prediction of compressive strength and modulus of elasticity of concrete using machine learning

- models. Proceedings of Materials Science and Technology (MS&T19), pp. 604-611, September 29-October 03, 2019, Portland, OR, U.S.
doi: [10.7449/2019mst/2019/mst_2019_604_611](https://doi.org/10.7449/2019mst/2019/mst_2019_604_611) [Presentation and Paper]
- [13] Fan, L., Alhaj, A., **Ma, H.**, & Chen, G. (2019). Assessing moisture content on the surface of mortar samples from hyperspectral imaging. 9th International Conference on Structural Health Monitoring of Intelligent Infrastructure (SHMII-9), August 4-7, St Louis, MO, U.S. [Presentation and Paper]
- [12] **Ma, H.** (2019). Phosphate-Base Cements (P-BCs) - Reactions, Microstructure, and Performance. 10th Advances in Cement-Based Materials archive (Cements 2019), June 16-18, 2019, Urbana, IL, U.S. [Presentation only]
- [11] Liao, W., & **Ma, H.** (2019). Mitigating curling of concrete pavement by phase change materials: incorporation, measurement, and modeling. American Concrete Institute Spring 2019 Convention – Nordique Concrete, March 24-28, 2019, Québec City, Québec, Canada. [Presentation only]
Online video: https://youtu.be/MGWD_NepRWw
- [10] Liao, W., & **Ma, H.** (2018). A passive construction solution for building energy efficiency using PCM in concrete. American Concrete Institute Fall 2018 Convention – Dream Big, Build Bigger, October 14-18, 2018, Las Vegas, U.S. [Presentation only]
- [9] Hao, W., **Ma, H.**, Sun, G., & Li, Z. (2018). Developing high performance magnesium phosphate cement composite bipolar plates for fuel cells. The 10th International Conference on Applied Energy (ICAE2018), August 22-25, 2018, Hong Kong. [Presentation and Paper]
- [8] **Ma, H.**, & Huang, Y. (2016). Strength and water resistance of low-grade fly ash incorporated magnesia-phosphate cement based materials. *Proceedings of the 4th International Conference on Sustainable Construction Materials and Technologies (SCMT4, S291)*. August 7-11, 2016, Las Vegas, U.S. [Presentation and Paper]
- [7] Lu, Z., Li, Z., & **Ma, H.** (2016). The perspective applications of graphene oxide in construction and building materials. In *Advanced Materials – TechConnect Briefs 2016* (pp. 197-200), 10th Annual TechConnect World Innovation Conference and Expo, held jointly with the 19th Annual Nanotech Conference and Expo, and the 2016 National SBIR/STTR Conference, May 22-25, 2016, Washington DC, U.S. [Presentation and Paper]
- [6] Li, Z., **Ma, H.**, & Tang, S. (2012). The assessment of porosity in concrete and its influence to service life design of concrete. In J. Teng, & J. Dai (Ed.), *Proceedings of the 1st International Conference on Performance-based and Life-cycle Structural Engineering*. December 5-7, 2012, Hong Kong. [Presentation and Paper]
- [5] Li, Z., **Ma, H.**, & Tang, S. (2012). From pore structure assessment to service life design of concrete structures (Keynote). In G. Ye, K. van Breugel, W. Sun, & C. Miao (Ed.), *Proceedings of the 2nd International Conference on Microstructural-related Durability of Cementitious Composites (RILEM Pro 083)*

- (pp. 76-87). Bagnaux, France: RILEM Publications SARL. [[Presentation and Paper](#)]
- [4] **Ma, H.**, & Li, Z. (2011). Multi-scale modeling of the microstructure of concrete. *Proceedings of the Twenty-Fourth KKCNN Symposium on Civil Engineering* (pp. 531-534). December 14-16, 2011, Hyogo, Japan. [[Presentation and Paper](#)] doi: [10.13140/2.1.1682.7841](https://doi.org/10.13140/2.1.1682.7841)
- [3] **Ma, H.**, & Li, Z. (2011). Modeling cement paste at micro-scale. *Proceedings of the 2011 World Congress on Advances in Structural Engineering and Mechanics* (pp. 992-1004). Seoul, Korea: Techno-Press. [[Presentation and Paper](#)]
- [2] Tian, Y., Li, Z., **Ma, H.**, Jin, X., & Jin, N. (2011). An investigation on the microstructure formation of polymer modified mortars in the presence of polyacrylate latex. In C. Leung, & K. Wan (Ed.), *Proceedings of the International RILEM Conference on Advances in Construction Materials Through Science and Engineering (RILEM Pro 079)* (pp. 71-77). Bagnaux, France: RILEM Publications SARL. [[Presentation and Paper](#)]
- [1] Liu, W., Dong, B., **Ma, H.**, & Xing, F. (2009). Influence of sea sand on the hydration behavior of cement based materials. In X. Zhou, G. He, H. Xiao, & B. Yan (Ed.), *Proceedings of the 4th International Symposium on Lifetime Engineering of Civil Infrastructure* (pp. 1009-1013). October 26-28, 2009, Changsha, China. [[Presentation and Paper](#)]

Patents

- [2] **Ma, H.**, & Liao, W. (2022). Large-scale carbon mineralization through oxalation. PCT/US22/40355, filed on 08/15/2022.
- [1] Li, Z., **Ma, H.**, & Hao, W. (2017). Magnesium phosphate cement based bipolar plate composite material. [US Patent, US9774043B2](#), granted on 09/26/2017.

Standards, Codes and Guidelines

- [1] Cavanaugh, K., Pathak, R., Clark, C., McGinley, W., Dixon, D., VanGeem, M., Lorenz, E., Zhou, H., & **Ma, H.** (2021). Thermal bridge mitigation for buildings having concrete and masonry walls and masonry veneer – Code requirements and commentary. [ACI Standard, ACI CODE-122.1-21](#), reported by Joint ACI-TMS Committee 122.

Invited Lectures/Seminars:

- [24] **Ma, H.**, “Coal-Derived Materials for Building, Infrastructure, and Other Applications”, October 20, 2022, Future of Coal Workshop – Towards a Sustainable Future Use of Coal, Rolla, MO.
- [23] **Ma, H.**, “Carbon-Negative Supplementary Cementitious Materials Derived from Solid Wastes”, August 18, 2022, EPRI CCP Beneficial Use Summer Meeting, Charlotte, NC.

- [22] **Ma, H.**, “Carbon-Negative Upcycling of Solid Wastes in Construction Materials”, February 16, 2022, Missouri Department of Natural Resources Solid Waste Forum, Jefferson City, MO ([Virtual, 3:31-4:09](#)).
- [21] **Ma, H.**, “Advances in Materials for Sustainable Infrastructure: Eco-Efficient Cements, Concrete Durability and Demolition Waste Management”, December 28, 2021, School of Civil Engineering, Tianjin University (Online Webinar).
- [20] **Ma, H.**, “Advances in Materials for Sustainable Infrastructure: Eco-Efficient Cements, Concrete Durability and Demolition Waste Management”, December 20, 2019, School of Civil Engineering, Tianjin University, Tianjin, China.
- [19] **Ma, H.**, “Advances in Materials for Sustainable Infrastructure: Eco-Efficient Cements, Concrete Durability and Demolition Waste Management”, December 19, 2019, School of Materials Science and Engineering, Tongji University, Shanghai, China.
- [18] **Ma, H.**, “Future Eco-Efficient Cements: SCMs, Alternative Cements and Cement Efficiency Enhancers”, December 16, 2019, College of Civil and Transportation Engineering, Shenzhen University, Shenzhen, China.
- [17] **Ma, H.**, “Potential Applications of Natural Polymers in Cement-Based Materials”, December 14, 2019, College of Chemistry and Molecular Sciences, Wuhan University, Wuhan, China.
- [16] **Ma, H.**, “Advances in Materials for Sustainable Infrastructure: Eco-Efficient Cements, Concrete Durability and Demolition Waste Management”, December 14, 2019, State Key Laboratory of Silicate Materials for Architectures, Wuhan University of Technology, Wuhan, China.
- [15] **Ma, H.**, “Cements in the future: Eco-efficiency and “individuation”, November 4, 2019, Structural Engineering Seminar at Department of Civil and Environmental Engineering, University of Missouri – Columbia, Missouri.
- [14] **Ma, H.**, “Overview of Current Studies on Advanced Materials for Sustainable Infrastructure”, June 19, 2019, Lyles School of Civil Engineering, Purdue University, West Lafayette, Indiana.
- [13] **Ma, H.**, “Acid-Base Cements for Extremely Durable Construction and Repair – Reactions, Microstructure, and Properties”, April 22, 2019, Transportation Research Conference, Missouri University of Science and Technology, Missouri.
- [12] **Ma, H.**, “Magnesium phosphate cements: from fundamentals to applications”, January 17, 2019, Department of Civil Engineering and Engineering Mechanics, Columbia University, New York.
- [11] **Ma, H.** “Advances in alternative cements development”, January 16, 2019, Department of Civil, Environmental and Ocean Engineering, Stevens Institute of Technology, Hoboken, New Jersey.
- [10] **Ma, H.** “Studies on advanced materials for sustainable infrastructure”, June 11, 2018, School of Materials Science Engineering, Southeast University, Nanjing, China.
- [9] **Ma, H.** “From materials to structures: characterization, modeling, monitoring, and rehabilitation”, June 11, 2018, School of Civil and Transportation Engineering, Hohai University, Nanjing, China.

- [8] **Ma, H.** “Studies on advanced materials for sustainable infrastructure”, June 04, 2018, Institute of Applied Physics and Materials Engineering, University of Macau, Macau.
- [7] **Ma, H.** “Advances in novel binding mechanisms and binder materials”, May 29, 2018, School of Civil Engineering, Qingdao University of Technology, Qingdao, China.
- [6] **Ma, H.** “Frontiers in durability study of concrete”, January 4, 2018, College of Civil Engineering, Shenzhen University, Shenzhen, China.
- [5] **Ma, H.** “Modeling hydration kinetics, microstructure, and transport properties of contemporary concrete”, December 25, 2017, School of Civil Engineering, Central South University, Changsha, China.
- [4] **Ma, H.** “Improving Impermeability of Concrete – Roles of Silica Fume, Fly Ash, and GGBS”, November 27, 2015, China Academy of Railway Sciences, Beijing, China.
- [3] **Ma, H.** “Multi-scale Modeling of Transport Properties of Contemporary Concrete”, May 20, 2015, Shenzhen University, Shenzhen, China.
- [2] **Ma, H.** “Microstructural Modeling of Traditional and Novel Cement-Based Materials”, April 30, 2015, Chongqing University, Chongqing, China.
- [1] **Ma, H.** “Characterization and Modeling of the Microstructure of Concrete: Gel, Paste and ITZ”, April 22, 2015, Shenzhen University, Shenzhen, China.

Teaching:

At Missouri S&T

- CE 3116 – Construction Materials: Properties and Testing, since 2016.
- CE 5113 – Composition and Properties of Concrete, since 2018.
- CE 2210 – Mechanics of Materials, since 2019.
- CE 6001 – Characterization and Modeling of Cementitious Materials – (CM)², since 2021.
- CE 6801 – Advanced Concrete Science and Technology, since 2022.

At the Hong Kong University of Science and Technology

- Advanced Concrete Technology, 2014-2015, as a Substitute Teaching Staff;
- Construction Materials, 2013-2014, as a Substitute Teaching Staff;
- Surveying and Surveying Camp, Civil Engineering Drawing, Structural Analysis, Construction Materials Lab, 2008~2012, as a Teaching Assistant.

Professional Service Activities:

Editorial Board Member

ASCE Materials in Civil Engineering (Associate Editor, 2020 –)

ES Materials & Manufacturing (2020 –)

Frontiers in Materials (Structural Materials specialty, 2015 – ; Guest Associate Editor on *Molecular Simulation on Cementitious Materials: From Computational Chemistry Method to Application*, 2019-2020)

International Journal of Distributed Sensor Networks (Guest Editor for *Smart Infrastructure Network: Sensing, Big Data and Mathematical Methods*, 2018)
Journal of Zhejiang University – Science A (2019 –)

Grant Reviewer

American Chemical Society – Petroleum Research Fund (2020, 2021)
Engineer Research and Development Center of U.S. Army Corps of Engineers
(2018-2021)
Natural Sciences and Engineering Research Council of Canada (2016-2018)
National Science Foundation
Research Foundation - Flanders (FWO), Belgium (2018; FWO Review College
membership, for panels 2021-2023)
Research Grants Council (RGC) of Hong Kong (2021, 2022)

Journal Reviewer

ACS Sustainable Chemistry & Engineering
Additive Manufacturing
Advances in Cement Research
Applied Energy
Applied Materials Today
Applied Thermal Engineering
Cement & Concrete Composites
Cement and Concrete Research
Ceramics International
Composites Part B: Engineering
Computational Materials Science
Computers & Structures
Construction and Building Materials
Corrosion Science
Current Advances in Civil Engineering
Engineering with Computers
Environmental Earth Sciences
European Journal of Environmental and Civil Engineering
ES Materials and Manufacturing
Frontiers of Structural and Civil Engineering
HKIE Transactions
International Journal of Impact Engineering
Journal of Civil Engineering and Construction Technology
Journal of Cleaner Production
Journal of Colloid and Interface Science
Journal of Composite Materials
Journal of Composites
Journal of Materials in Civil Engineering, ASCE
Journal of Materials Science
Journal of Physics and Chemistry of Solids

Journal of the American Ceramic Society
Journal of Vibration and Control
Materials, MDPI
Materials & Design
Materials and Structures, RILEM
Materials Characterization
Materials Letters
Materials Research Bulletin
Materials Research Innovations
Materials Today Communications
Mathematical and Computational Applications, MDPI
Measurement
Nanomaterials, MDPI
Physical Chemistry and Chemical Physics
Plos One
Powder Technology
Scientific Reports
Solar Energy
The Journal of Physical Chemistry C

Professional Society Member

American Ceramic Society (ACerS, 2019-present)
American Concrete Institute (ACI, 2008-present), involved committees:
 122 Energy Efficiency of Concrete and Masonry Systems (voting member)
 236 Material Science
 241 Nanotechnology (2015-2019)
 242 Alternative Cements
 546E Corrosion Studies (voting member)
American Society of Civil Engineers (ASCE, 2017-present)
International Union of Laboratories and Experts in Construction Materials,
Systems and Structures (RILEM, 2009-2012)

Conference Service

- [12] Scientific Committee member, the 6th International Conference on Smart Monitoring, Assessment and Rehabilitation of Civil Structures, Shanghai, China, September 6-8, 2022.
- [11] Discussion Leader, Session topic: Outside-the-Box Low-CO₂ Binding Materials, Gordon Research Seminars – Concrete Solutions Towards Carbon Neutral Construction by 2050, Ventura, CA, U.S., February 22-23, 2020.
- [10] Moderator, technical session: Issues and Solutions, IACIP Annual Workshop, Transportation Research Board 99th Annual Meeting, Washington D.C., U.S., January 12-16, 2020.
- [9] Organizing Committee member, The 10th International Association of Chinese Infrastructure Professionals (IACIP) Annual Workshop, Washington D.C., U.S., January 12, 2020.

- [8] Moderator, technical session: *SHM-based Structural Performance Evaluation and Case Studies*, 9th International Conference on Structural Health Monitoring of Intelligent Infrastructure (SHMII-9), St. Louis, MO, U.S., August 4-7, 2019.
- [7] Organizing Committee member, 9th International Conference on Structural Health Monitoring of Intelligent Infrastructure (SHMII-9), St. Louis, MO, U.S., August 4-7, 2019.
- [6] Moderator, technical session: *Phase Change Materials in Concrete* (TC 236), ACI Spring Convention 2019, Québec City, Québec, Canada, March 24-28, 2019.
- [5] Moderator, Mini Session: *New Developments in Energy Code Compliance for Concrete and Masonry Structures* (TC 122), ACI Fall Convention 2018, Las Vegas, NV, U.S., October 14-18, 2018.
- [4] Scientific Committee member, 6th International Conference on Durability of Concrete Structures (ICDCS2018), Leeds, U.K., July 18-20, 2018.
- [3] Invited reviewer, ASCE Congress on Technical Advancement 2017, Duluth, M.N., U.S., September 10-13, 2017.
- [2] Technical Program Committee member, TRB ADC 60 2016 Summer Workshop, Asheville, N.C., U.S., July 26-29, 2016.
- [1] Chair of technical session *Emerging Binder Materials*, 5th International Conference on Durability of Concrete Structures, Shenzhen, China, June 30-July 2, 2016.