**Shimin Liu**

The Pennsylvania State University

Department of Energy and Mineral Engineering

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**EDUCATION**

Ph.D. in Engineering Science, 2012

**Southern Illinois University at Carbondale, Illinois, USA**

M.S. in Mineral Processing Engineering, 2007

**China University of Mining & Technology at Beijing, China**

B.S. in Environmental Engineering, 2005

**China University of Mining & Technology at Beijing, China**

**PROFESSIONAL APPOINTMENTS**

7/2024 – present Associate Department Head, Pennsylvania State University

7/2023 – present Professor, The Pennsylvania State University

7/2018 – 6/2023 Associate Professor, The Pennsylvania State University

1/2013 – 6/2018 Assistant Professor, The Pennsylvania State University

5/2012 – 12/2012 Research Scientist, Southern Illinois University

8/2007 – 5/2012 Research Assistant, Southern Illinois University

**RESEARCH INTERESTS**

Flow of fluids in porous media (with application to gas flow in coal/shale, coalbed methane reservoir engineering, carbon sequestration in geologic media and abandoned coal mines); imaging (micro-X-ray computed tomography, synchrotron X-ray scattering, neutron scattering/diffracting, scanning/transmission electron microcopy) and analysis to study physical structure of rocks; flow-induced micro-structuring of rocks; geomechanical responses of unconventional reservoirs with depletion, mine ground control and mine ventilation, health and safety

**HONORS/AWARDS RECEIVED**

* George H., Jr. and Anne B. Deike Chair Professor, Penn State University, 2023
* 2023 SPE Rossiter Raymond Award
* Thomas V. and Jean C. Falkie Faculty Fellowship, Penn State University, 2022
* Best Paper Award for 2021 International Journal of Coal Science and Technology
* 2021 Energy and Fuels Rising Stars – ACS Energy & Fuels Journal, 2021
* Top 25 Most Cited Article of Energy & Fuels in 2016
* Recognized by Springer Nature for Editorial Excellence, 2020
* Invited Associate Editor, Environmental Science and Pollution Research, 2022
* Invited as Editor-in-Chief, International Journal of Coal Science and Technology, Springer, 2018-present
* The 2017 Freeport-McMoRan Career Development Grant from Society for Mining, Metallurgy & Exploration
* Best Keynote Award, 3rd International Symposium on Unconventional Geomechanics, Wuhan, China, 2016
* Kreutzberger Early Career Assistant Professor, Penn State University 2016
* Gladys Snyder Grant Award, Penn State University, 2015
* Excellent Reviewer Awards:
* Journal of Natural Gas Science and Engineering, 2013, 2017
* Fuel Journal, 2016, 2017
* Beam Time Award, DOE Oak Ridge National Laboratory (ORNL), 2014, 2015
* Wilson Research Initiation Award, Penn State University, 2013
* Doctoral Fellowship, SIU (Fall 2010, Spring and Summer 2011)

**LIST OF PUBLICATIONS**

**A. Peer Reviewed Journal Publications**

**2025**

1. Shi, Y., Wang, R., **Liu, S.**, Zhu, X., and Jiao, S., 2025. Co (1 1 1) loaded on amorphous Co(OH)2 − derived porous Ni with maximized Co (1 1 1) utilization for hydrogen evolution reaction, Fuel, v. 398, 135426.
2. Zhang, J., Hou, X., **Liu, S.**, Zhu, Y., Liu, A., Fan, L., Wang, Y., and Zhang, H., 2025. Quantifying and modeling of coal permeability spatiotemporal response: Implications for gas recovery and CO2 sequestration, Fuel, v. 388, 134561.
3. Liu, A., **Liu, S**., Zhang, K., and Xia, K., 2025. Competitive sorption of CH₄ and CO₂ on coals: Implications for carbon geo-storage, Separation and Purification Technology, v. 354, 129399.
4. Elsworth, D., Li, Z., Yu, P., An, M., Zhang, F., Huang, R., Sun, Z., Cui, G., Chen, T., Gan, Q., Zhao, Y., Liu, J., and **Liu, S**., 2025. Constraints on triggered seismicity and its control on permeability evolution, Journal of Rock Mechanics and Geotechnical Engineering, v. 17(1), pp. 20-30.
5. He, X., Elsworth, D., and **Liu, S**., 2024. Millisecond-resolved gas sorption kinetics and time-dependent diffusivity of coal, Rock Mechanics and Rock Engineering, v. 58, pp 4421-4439.

**2024**

1. Liu, T., Li, M., Lin, B., Li, J., **Liu, S**., and Xu, J., 2024. Evolution of coal fractures and its influence on permeability during progressive failure based on in situ CT scanning, Energy&Fuels, v. 38(15), pp. 14119-14135.
2. Wang, T., Tian, L., Wu, J., Cao, Y., Wang, L., Shi, B., Sun, M., **Liu, S.**, and Hu, Y., 2024. Fracture properties of nitrogen–slick water composite fracturing in coal reservoir, Processes, v. 12(9), 1949.
3. Rahimi, E., **Liu, S.**, and Wang, M., 2024. A laboratory study of coal-to-gas bioconversion through bio-seeding sludge in the primary coal substrate, Energy, v. 310, 133259.
4. Huang, Q., Yan, Y., Yu, B., Wang, G., **Liu, S**., Xu, H., Liu, T., Li, M., and Feng, X., 2024. Multiscale characterization of surfactant-enhanced coal rock pore-fracture imbibition, Process Safety and Environmental Protection, v. 190, pp 1494-1505.
5. Yang, Y., Zandanel, A., **Liu, S**., Neil, C., Germann, T., and Gross, M., 2024. Temperature dependence of hydrogen diffusion in reservoir rocks: Implications for hydrogen geologic storage, Energy Advances, in press.
6. Shi, B., Cao, Y., Li, Z., **Liu, S**., and Qi, Y., 2024. Experimental study on permeability enhancement of anthracite by high pressure nitrogen injection and soaking, Energy&Fuels, v. 38(9), pp. 7850-7861.
7. Chang, X., Lin, S., Yang, C., Wang, K., **Liu, S**., and Guo, Y., 2024. A critical review of ScCO2-enhanced gas recovery and geologic storage in shale reservoirs, Gas Science and Engineering, v. 125, 205317.
8. Sun, C., **Liu, S**., Li, S., Wang, K., Li, X., and Zhang, Z., 2024. Effect of nano-SiO2 particles on THF hydrate induction time and its distribution, Gas Science and Engineering, v. 125, 205320.
9. Liu, Y., Liu, Q., Wu, Z., **Liu, S**., Kang, Y., and Tang, X., 2024. Cross-scale mechanical softening of Marcellus shale induced by CO2-water-rock interactions using nanoindentation and accurate grain-based modeling, Underground Space, v. 19, pp 26-46.
10. Azam, S., **Liu, S**., Bhattacharyya, S., and Mishra, D., 2024. Prevalence of nano-sized coal mine dust in north and central Appalachian coal mines–Insights from SEM-EDS imaging, Journal of Hazardous Materials, v. 476, 135226.
11. Liu, A., and **Liu, S**., 2024. Evaluation of parameters impacting grey H2 storage in coalbed methane formations, Renewable and Sustainable Energy Reviews, v. 202, 114686.
12. Azam, S., **Liu, S**., Bhattacharyya, S., and Zheng, S., 2024. Assessing the hazard of diesel particulate matter (DPM) in the mining industry: A review of the current state of knowledge, International Journal of Coal Science & Technology, v. 11(1), 62.
13. Fu, S., Wang, L., Li, S., NI, S., Cheng, Y., Zhang, X., and **Liu, S**., 2024. Re-thinking methane storage mechanism in highly metamorphic coalbed reservoirs — A molecular simulation considering organic components, Energy, v. 293, 130444.
14. Meng, B., Shi, B., Cao, Y., Wang, L., and **Liu, S**., 2024. Simulation study of N2-hydraulic compound fracturing based on volumetric opening model, ACS Omega, v. 9, pp 3885-3893.
15. Yang, Y., **Liu, S**., and Ma, H., 2024. Impact of unrecovered shale gas reserve on methane emissions from abandoned shale gas wells, Science of the Total Environment, v 913, 169750.
16. Rahimi, E., **Liu, S.**, and Wang, M., 2024. Investigation of methane-rich gas production from the co-bioconversion of coal and anaerobic digestion sludge, Fuel, v. 357, 129565.
17. Li, Y., Guo, X., Song, D., **Liu, S.**, Pan, J., and Wang, H., 2024. Expulsion of small molecule hydrocarbons and expansion of nanopores effect in tectonically deformed coal evolution, Fuel, v. 357, 129961.

**2023**

1. Zhang, J., Hou, X., **Liu, S**., Chen, L., and Wang, Y., 2023. New data-driven method for in situ coalbed methane content evolution: a BP neural network prediction model optimized by grey relation theory and particle swarm, Energy&Fuels, v. 37(14), pp. 10344-10354.
2. He, S., He, X., Mitri, H., Meng, S., Wu, Q., Ren, T., and **Liu, S.,** 2023 Advances in mining safety theory, technology, and equipment, Advances in Geo-Energy Research, v. 10(2), pp 71-76
3. Liu, A., **Liu, S**., Zhang, R., Sang, G., and Xia, K., 2023. Cyclical water vapor sorption-induced structural alterations of mine roof shale, International Journal of Coal Geology, v. 273, 104267.
4. Zhao, W., Dong, H., Wang, K., **Liu, S**., and Yan, Z., 2023. Evolution from gas outburst to coal outburst: An analysis from the perspective of asynchronous transfer difference of gas mass and coal deformation, International Journal of Heat and Mass Transfer, v. 217, 124736
5. Azam, S., **Liu, S**., Bhattacharyya, S., and Liu, A., 2023. Measurement and modeling of water vapor sorption on nano-sized coal particulates and its implication on its transport and deposition in the environment, Science of the Total Environment, v. 889, 164095.
6. Azam, S., Kurashov, V., Golbeck, J., Bhattacharyya, S. Zheng, S., and **Liu, S**., 2023. Comparative studies of environmentally persistent free radicals on nano-sized coal dusts, Science of the Total Environment, v. 878, 163163.
7. Liu, A., **Liu, S.**, Xia, K., Liu, P., Yang, Y., and Wang, G., 2023. Characterizing anisotropic swelling strains of coal using combined rosette strain gauge and CT-scans, Rock Mechanics and Rock Engineering, v. 56, pp 5405-5426.
8. Ren, J., Zhao, Y., Wang, W., Guo, J., Sun, Z., and **Liu, S**., 2023. Optimal design of a protective coal pillar with a buried pipeline in a thick loose layer in western China: methodology and case study, Rock Mechanics and Rock Engineering, v. 56, pp 2879-2896.
9. Gendrue, N., **Liu, S**., Bhattacharyya, S., and Clister, R., 2023. An investigation of airflow distributions with booster fan for a large opening mine through field study and CFD modeling, Tunnelling and Underground Space Technology, v. 132, 104856.
10. Wang, S., Chen, H., Wang, X., Tang, Y., **Liu, S**., Schobert, H., Song, X., and Zeng, F., 2023. Elementary evolution in coal under natural conditions: Coals affected by igneous intrusions, Fuel, v. 334, 126708.
11. Liu, A., and **Liu, S**., 2023. Coupled model of multi-mechanistic gas–water transport behavior in tight shale, Energy&Fuels, v. 37(4), pp. 2860-2874.
12. Guo, S., Cao, Y., Zhang, J., Zhang, X., Meng., B, and **Liu, S**., 2023. Pore-microfracture structure alteration of coal induced by high-pressure CO2 gas fracturing, Energy&Fuels, v. 37(6), pp. 4341-4348.
13. Liu, A., and **Liu, S**., 2023. Hydrogen sorption and diffusion in coals: Implications for hydrogen geo-storage, Applied Energy, v. 334, 120746.

**2022**

1. Tian, L., Li, Z., Cao, Y., **Liu, S**., and Song, Y., 2022. *In situ* stress distribution and variation monitored by microseismic tracking on a fractured horizontal well: a case study from the Qinshui Basin, ACS Omega, v. 7, 14363-14370.
2. Liu, Y., **Liu, S**., Liu, A., and Kang, Y., 2022. Determination of mechanical property evolutions of shales by nanoindentation and high-pressure CO2 and water treatments: a nano-to-micron scale experimental study, Rock Mechanics and Rock Engineering, v. 55, pp 7629-7655.
3. Tan, B., Song, X., Zhang, B., Shao, Z., Li, Z., and **Liu, S**., 2022. Study on the effect of different seawater mass ratio on coal spontaneous combustion characteristics, Thermochimica Acta, v. 716, 179328.
4. Liu, Y., Liu, A., **Liu, S**., and Kang, Y., 2022. Nano-scale mechanical properties of constituent minerals in shales investigated by combined nanoindentation statistical analyses and SEM-EDS-XRD techniques, International Journal of Rock Mechanics and Mining Sciences, v. 159, 105187.
5. Liu, A., **Liu, S**., Liu, Y., Liu, B., and Liu, T., 2022. Characterizing mechanical heterogeneity of coal at nano-to-micro scale using combined nanoindentation and FESEM-EDS, International Journal of Coal Geology, v. 261, 104081.
6. Tang, S., Tang, D., **Liu, S**., Li, S., Tang, J., Wang, M., Zhang, A., and Pu, Y., 2022. Multiscale pore characterization of coal measure reservoirs and gas storage and transport behavior in Yanchuannan gas field of China, AAPG Bulletin, v. 106(12), pp 3187-2415.
7. Liu, A., and **Liu, S**., 2022. Mechanical property alterations across coal matrix due to water-CO2 treatments: A micro-to-nano scale experimental study, Energy, v. 248, 123575.
8. Shi, B., Cao, Y., Tian., L, Zhang, J., and **Liu, S**., 2022. CO2 gas fracturing in high dip angled coal seams for improved gas drainage efficiency at Hashatu coal mine, Energy&Fuels, v. 36(5), pp 2763-2774.
9. Liu, P., Liu, A., **Liu, S**., and Qi, L., 2022. Experimental evaluation of ultrasound treatment induced pore structure and gas desorption behavior alterations of coal, Fuel, v. 307, 121855.
10. Cao, Y., Zhang, J., Zhang, X., **Liu, S**., and Elsworth, D., 2022. Micro-fractures in coal induced by high pressure CO2 gas fracturing, Fuel, v. 311, 122148.
11. Yang, Y., **Liu, S**. and Clarkson, C., 2022. Quantification of temperature-dependent sorption isotherms in shale gas reservoirs: experiment and theory, SPE Journal, v. 27(05), pp 3001-3019.

**2021**

1. Huang, Q., Li, J., **Liu, S**., and Wang, G., 2021. Experimental study on the adverse effect of gel fracturing fluid on gas sorption behavior for Illinois coal, International Journal of Coal Science & Technology, v. 8(6), pp 1250-1261.
2. Chen, S., Yao, S., Wang, Y., **Liu, S**., Wang, X., Zhang, Y., and Wang, H., 2021. Investigation of pore evolution and variation with magma intrusion on Permian Gufeng shale formation and their implications on gas enrichment, Journal of Natural Gas Science and Engineering, v. 96, 104277.
3. Sun, Y., Li, S., Lu, C., **Liu, S**., Chen, W., and Li, X., 2021. The characteristics and its implications of hydraulic fracturing in hydrate bearing clayey silt, Journal of Natural Gas Science and Engineering, v. 95, 104189.
4. Liu, Y., **Liu, S.**, Zhang, R., and Zhang, Y., 2021. The molecular model of Marcellus shale kerogen: Experimental characterization and structure reconstruction, International Journal of Coal Geology, v. 246, 103833.
5. Zhao, Y., Sun, B., **Liu, S.**, Zhang, C., He, X., Xu, D. and Tang, W., 2021. Identification of mining induced ground fissures using UAV and infrared thermal imager: Temperature variation and fissure evolution, ISPRS Journal of Photogrammetry and Remote Sensing, v. 180, pp 45-64.
6. Wang, Z., **Liu, S.**, and Qin, Y., 2021. Coal wettability in coalbed methane production: A critical review, Fuel, v. 303, 121277
7. Zhang, R., and **Liu, S**., 2021. Investigating hierarchical gas confinement in high-rank coal through small-angle neutron scattering, Energy & Fuels, v. 35, pp 13109-13123.
8. Liu, Y., **Liu, S**., and Kang, Y., 2021. Probing nanomechanical properties of a shale with nanoindentation: heterogeneity and the effect of water–shale interactions, Energy & Fuels, v. 35, pp 11930-11946.
9. Yang, Y., and **Liu, S.**, 2021. Integrated modeling of multi-scale transport in coal and its application for coalbed methane recovery, Fuel, v. 300, 120971.
10. Hou, X., **Liu, S**., Li, G., Zhu, Y., and Liu, A., 2021. Quantifying and modeling of in situ stress evolutions of coal reservoirs for helium, methane, nitrogen and CO2 depletions, Rock Mechanics and Rock Engineering, v. 54, pp 3701-3719.
11. Lu, T., Long, S., Li, Z., **Liu, S**., Liu, Y., Adenutsi, CD., and Peng, Z., 2021. Novel model for rate transient analysis in stress-sensitive shale gas reservoirs, ACS Omega, v. 6, pp 14015-14029.
12. Zhang, K., Meng, Z., **Liu, S**., Hao, H., and Chen, T., 2021. Laboratory investigation on pore characteristics of coals with consideration of various tectonic deformations, Journal of Natural Gas Science and Engineering, v. 91, 103960.
13. Yang, Y., **Liu, S.**, and Chang, X., 2021. Fracture stiffness evaluation with waterless cryogenic treatment and its implication in fluid flowability of treated coals, International Journal of Rock Mechanics and Mining Sciences, v. 142, 104727.
14. Zhang, K., Meng, Z., and **Liu, S**., 2021. Comparisons of methane adsorption/desorption, diffusion behaviors on intact coals and deformed coals: Based on experimental analysis and isosteric heat of adsorption, Energy & Fuels, v. 35(7), pp 5975-5987.
15. Zhang, R., **Liu, S**., and Zheng, S., 2021. Characterization of nano-to-micron sized respirable coal dust: particle surface alteration and the health impact, Journal of Hazardous Materials, v. 413, 125447.
16. Huang, Q., **Liu, S**., Wu, B., Wang, G., Li, G., and Guo, Z., 2021. Role of VES-based fracturing fluid on gas sorption and diffusion of coal: an experimental study of Illinois basin coal, Process Safety and Environmental Protection, v. 148, pp 1243-1253.
17. Liu, A., **Liu, S**., Liu, P., and Harpalani, S., 2021. The role of sorption-induced coal matrix shrinkage on permeability and stress evolutions under replicated in situ condition for CBM reservoirs, Fuel, v. 294, 120530.
18. Liu, A., AND **Liu, S**., 2021. A fully-coupled water-vapor flow and rock deformation/damage model for shale and coal: Its application for mine stability evaluation, International Journal of Rock Mechanics and Mining Sciences, v. 146, 104880.
19. Liu, A., **Liu, S**., Liu, P., and Wang, K., 2021. Water sorption on coal: effects of oxygen containing function groups and pore structure, International Journal of Coal Science & Technology, v. 8, pp 983-1002.
20. Zhou, X., **Liu, S**., and Zhang, Y., 2021. Permeability evolution of fractured sorptive geomaterials: a theoretical study on coalbed methane reservoir, Rock Mechanics and Rock Engineering, v. 54, pp 3507-3525.
21. Fan, L., and **Liu, S**., Zhao, W., and Hou, X., 2021. Investigation of fluid-injection-induced coal stiffness alteration using a single-core multistage triaxial test, International Journal of Coal Geology, v. 237, 103692.
22. Fan, L., and **Liu, S**., 2021. Respirable nano-particulate generations and their pathogenesis in mining workplaces: a review, International Journal of Coal Science & Technology, v. 8(2), pp 179-198.
23. Fan, L., and **Liu, S**., 2021. Special issue on mine dust research: health effects and control technologies, International Journal of Coal Science & Technology, v. 8(2), pp 177-178.
24. Sang, S., and **Liu, S**., 2021. Carbonate caprock-brine-CO2 interaction: alteration of hydromechanical properties and implications on CO2 leakage, SPE Journal, v. 26(05), pp 2780-2792.
25. Tang, S., **Liu, S**., Tang, D., Tao, S., Zhang, A., Pu, Y. and Zhang, T., 2021. Occurrence of fluids in high dip angled coal measures: geological and geochemical assessments for southern Junggar Basin, China, Journal of Natural Gas Science and Engineering, v. 88, 103827.
26. Fan, L., and **Liu, S**., 2021. A novel experimental system for accurate gas sorption and its application to various shale rocks, Chemical Engineering Research and Design, v 165, pp 180-191.
27. Zhang, R., **Liu, S**., San-Miguel, A., Schweins, R., Le-Floch, S., and Pischedda, V., 2021. Nanoscale coal deformation and alteration of porosity and pore orientation under uniaxial compression: An *in situ* SANS study, Rock Mechanics and Rock Engineering, v. 54, pp 3593-3608.
28. Li, Y., Song, D., **Liu, S**., Ji, X., and Hao, H., 2021. Evaluation of pore properties in coal through compressibility correction based on mercury intrusion porosimetry: A practical approach, Fuel, v. 291, 120130.
29. Huang, Q., **Liu, S**., Wang, G., and Cheng, W., 2021. Evaluating the changes of sorption and diffusion behaviors of Illinois coal with various water-based fracturing fluid treatments, Fuel, v. 283, paper 118884.
30. Wang, Y., Wu, C., Qin, Y., **Liu, S**., and Zhang, R., 2021. Multi-angle investigation of the fractal characteristics of nanoscale pores in the lower Cambrian Niutitang shale and their implications for CH4 adsorption, Journal of Nanoscience and Nanotechnology, v. 21(1), pp 156-167.

**2020**

1. Sang, G., **Liu, S**. Elsworth, D., Zhang, R., and Bleuel, M., 2020. Pore-scale water vapor condensation behaviors in shales: an experimental study, Transport in Porous Media, v 135, pp 713-734.
2. Yang, Y., and **Liu, S**., 2020. Review of shale gas sorption and its models, Energy & Fuels, v 34 (12), pp 15502-15524.
3. Zhao, Y., Liu, T., Danesh N.N., Sun, Y., **Liu, S**., and Wang, Y., 2020. Quantification of pore modification in coals due to pulverization using synchrotron small angle X-ray scattering, Journal of Natural Gas Science and Engineering, v. 84, 103669.
4. Zhao, W., Wang, K., **Liu, S.**, Ju, Y., Zhou, H., Fan, L., Yang, Y., Cheng, Y., and Zhang, X., 2020. Asynchronous difference in dynamic characteristics of adsorption swelling and mechanical compression of coal: Modeling and experiments, International Journal of Rock Mechanics and Mining Sciences, v. 135, paper 104498.
5. Wang, L., Xu, H., Cao, Y., and **Liu, S**., 2020. A poromechanical model of hydraulic fracturing volumetric opening, Engineering Fracture Mechanics, v. 235, paper 107172.
6. Liu, A., Liu, P., and **Liu, S**., 2020. Gas diffusion coefficient estimation of coal: a dimensionless numerical method and its experimental validation, International Journal of Heat and Mass Transfer, v. 162, paper 120336
7. Liu, Y., Zhu, Y., **Liu, S**., and Zhang, C., 2020. Evolution of aromatic clusters in vitrinite-rich coal during thermal maturation by using HRTEM and FT-IR measurements, Energy & Fuels, v. 34, pp 10781-10792.
8. Liu, A., **Liu, S**., Wang, G., and Elsworth, D., 2020. Continuous compaction and permeability evolution in longwall gob materials, Rock Mechanics and Rock Engineering, v 53, pp 5489-5510.
9. Huang, Q., **Liu, S**., Cheng, W., and Wang, G., 2020. Fracture permeability damage and recovery behaviors with fracturing fluid treatment of coal: An experimental study, Fuel, v. 282, paper 118809.
10. Sang, G., **Liu, S**., and Elsworth, D., 2020. Evaluation and modeling of water vapor sorption and transport in nanoporous shale, International Journal of Coal Geology, v. 228, paper 103553.
11. Li, Y., Song, D., **Liu, S**., and Pan, J., 2020. Characterization of ultra-micropores and analysis of their evolution in tectonically deformed coals by low-pressure CO2 adsorption, XRD and HRTEM techniques, Energy & Fuels, v. 34, pp 9436-9449.
12. Liu, A., **Liu, S**., Hou, X., and Liu, P., 2020. Transient gas diffusivity evaluation and modeling for methane and helium in coal, International Journal of Heat and Mass Transfer, v. 159, paper 120091.
13. Zhao, W., Wang, K., Cheng, Y., **Liu, S.**, and Fan, L., 2020. Evolution of gas transport pattern with the variation of coal particle size: Kinetic model and experiments, Powder Technology, v. 367, pp 336-346.
14. Yang, Y., and **Liu, S**., 2020. Laboratory study of cryogenic treatment induced pore-scale structural alterations of Illinois coal and their implications on gas sorption and diffusion behaviors, Journal of Petroleum Science and Engineering, v. 194, 107507.
15. Liu, T., and **Liu, S**., 2020. The impacts of coal dust on miners' health: A review, Environmental Research, v. 190, paper 109849.
16. Liu, A., **Liu, S**., Wang, G., and Sang, G., 2020. Modeling of coal matrix apparent strains for sorbing gases using a transversely isotropic approach, Rock Mechanics and Rock Engineering, v. 53, pp 4163-4181.
17. Liu, T., Lin, B., Fu, X., and **Liu, S**., 2020. Organic geochemical and petrographic characteristics of the coal measure source rocks of Pinghu formation in the Xihu sag of the east China sea shelf basin: Implications for coal measure gas potential, Acta Geologica Sinica-English Edition, v. 94(2), pp 364-375.
18. Liu, T., Lin, B., Fu, X., and **Liu, S**., 2020. A new approach modeling permeability of mining-disturbed coal based on a conceptual model of equivalent fractured coal, Journal of Natural Gas Science and Engineering, v. 79, 103366.
19. Sang, G., **Liu, S**., and Elsworth, D., 2020. Quantifying fatigue-damage and failure-precursors using ultrasonic coda wave interferometry, International Journal of Rock Mechanics and Mining Sciences, v. 131, 104366.
20. Song, C., and **Liu, S.**, 2020. A novel approach of bulk strength enhancement through microbially-mediated carbonate cementation for mylonitic coal, Geomicrobiology Journal, v 37(8), pp 726-737.
21. Liew, M., Xiao, M., **Liu, S.**, and Rudenko, D., 2020. In situ seismic investigations for evaluating geotechnical properties and liquefaction potential of fine coal tailings, Journal of Geotechnical and Geoenvironmental Engineering, v. 146(5), 04020014.
22. Tian, Z., Lu, Y., **Liu, S.**, Shi, S., Li, H., and Ye, Q., 2020. Application of inorganic solidified foam to control the coexistence of unusual methane emission and spontaneous combustion of coal in the Luwa coal mine, China, Combustion Science and Technology, v. 192, No. 4, pp 638-656.
23. Wang, J., Elsworth, D., **Liu, S**., and Cao, Y., 2020. Reach and geometry of dynamic gas-driven fractures, International Journal of Rock Mechanics and Mining Sciences, v. 129, paper 104287.
24. Zhang, R., **Liu, S**., He, L., Blach, T., and Wang, Y., 2020. Characterizing anisotropic pore structure and its impact on gas storage and transport in coalbed methane and shale gas reservoirs, Energy&Fuels, v. 34, pp 3161-3172.
25. Hou, X., **Liu, S**., Zhu, Y.., and Yang, Y., 2020. Experimental and theoretical investigation on sorption kinetics and hysteresis of nitrogen, methane, and carbon dioxide in coals, Fuel, v. 268, paper 117349.
26. Zhao, W., Wang, K., **Liu, S**., and Cheng, Y., 2020. Gas transport through coal particles: Matrix-flux controlled or fracture-flux controlled?, Journal of Natural Gas Science and Engineering, v. 76, paper, 103216.
27. Liu, A., **Liu, S**., Wang, G., and Elsworth, D., 2020. Predicting fugitive gas emissions from gob-to-face in longwall coal mines: coupled analytical and numerical modeling, International Journal of Heat and Mass Transfer, v. 150, paper 119392.
28. Liu, T., **Liu, S**., Lin, B., Fu, X., Zhu, C., Yang, W., and Zhao, Y., 2020. Stress response during in-situ gas depletion and its impact on permeability and stability of CBM reservoir, Fuel, v. 266, paper 117083.
29. **Liu, S**., and Zhang, R., 2020. Anisotropic pore structure of shale and gas injection-induced nanoporealteration: A small-angle neutron scattering study, International Journal of Coal Geology, v. 219, paper 103384.
30. Tian, L., Cao, Y., **Liu, S**., Shi, B., Liu, J., and Elsworth, D., 2020. Coalbed methane reservoir fracture evaluation through the novel passive microseismic survey and its implications on permeable and gas production, Journal of Natural Gas Science and Engineering, v. 76, paper 103181.
31. Chakraborty, N., Karpyn, Z., **Liu, S**., Yoon, H., and Dewers, T., 2020. Experimental evidence of gas densification and enhanced storage in nanoporous shales, Journal of Natural Gas Science and Engineering, v. 76, paper 103120.
32. Wang, Y., Zhu, Y., Zhang, R., Anovitz, L. Bleuel, M., **Liu, S**., and Chen, S., 2020. SANS coupled with fluid invasion approaches for characterization of overall nanopore structure and mesopore connectivity of organic-rich marine shales in China, International Journal of Coal Geology, v. 217, paper 103343.
33. Hou, X., **Liu, S**., Zhu, Y.., and Yang, Y., 2020. Evaluation of gas contents for a multi-seam deep coalbed methane reservoir and their geological controls: In situ direct method versus indirect method, Fuel, v. 265, paper 116917.

**2019**

1. Pia., G. Cai, J., Zhang, Z., and **Liu, S**., 2019. Advances in Modelling of Heat and Mass Transfer in Porous Materials, Editorial, Advances in Materials Science and Engineering, 2 pages.
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**D. CONFERENCE PRESENTATIONS AND ABSTRACTS**

1. **Liu, S.**, 2025. Characterization of submicron-/nano-scale coal dusts and their effects on miners' pneumoconiosis and lung cancer for Appalachian coal mines, 2024 Mine Safety and Health Research Advisory Committee (MSHRAC) Meeting, Lexington, KY, USA, November 7, 2024.
2. **Liu, S.**, 2024. Characterization of submicron-/nano-scale coal dusts and their effects on miners' pneumoconiosis and lung cancer for Appalachian coal mines, 2024 Mine Safety and Health Research Advisory Committee (MSHRAC) Meeting, Lexington, KY, USA, November 7, 2024.
3. **Liu, S.**, 2024. Prevalence of nano-sized mine dusts and its geohealth implications. The 2nd Doctoral Student Forum of International Journal of Coal Science & Technology, Xi’an, Shanxi, China, October 24-27, 2024.
4. **Liu, S.**, 2024. Climate solutions accelerator project: health effects of mineral and carbon nanoparticulate. 2024 Penn State Millennium Café, University Park, PA, USA, October 1, 2024.
5. **Liu, S.**, 2024. Geological hydrogen: opportunities and challenges, The Second Workshop on Sorptive Rocks and Engineering, Wisla, Poland, September 17-21, 2024.
6. **Liu, S.**, 2024. The Overview of US Mineral Industry. Mineral Engineering Conference (MEC), Wisla, Poland, September 16-18, 2024.
7. **Liu, S.**, and Spellman, C., 2024. Blasting induced stress and its effect on pillar stability for stone mines. The 7th International Symposium Mine Safety Science and Engineering (ISMSSE), Pittsburgh, PA, USA, August 17-21, 2024.
8. **Liu, S.**, 2024. The role of coal on carbon emission control. North American Coalbed Methane Forum (NACBM), Southpointe, PA, USA, April 25, 2024.
9. **Liu, S.**, 2023. Laboratory testing of Mannville coal samples. 2023 Unconventional Resources Technology Conference (URTeC), Denver, CO, USA, June 13-15, 2023.
10. **Liu, S.**, 2023. CO2 gas blasting and its application for coal mine gas drainage. The Twentieth Pennsylvania Drilling and Blasting Conference, State College, PA, USA, November 16-17, 2023.
11. **Liu, S.**, 2023. CO2 gas blasting and its application for coal mine gas drainage. The Twentieth Pennsylvania Drilling and Blasting Conference, State College, PA, USA, November 16-17, 2023.
12. **Liu, S.**, 2023. Blasting induced stress wave and its implication on the pillar failure for stone mines. The 7th International Symposium on Dynamic Hazards in Underground Mines, Wollongong, NSW, Australia, September 27-29, 2023.
13. **Liu, S.**, 2023. CO2 storage in deep coal: hydrogen production by underground combustion of coal. The Workshop on Sorptive Rocks, Sponsored by International Society of Rock Mechanics (ISRM), Beijing, China, August 13-14, 2023.
14. **Liu, S.**, 2023. Cyclic moisture induced mudstone rock softening and their implications on time-dependent strength reduction and long-term mine roof stability. The 6th International Symposium on Mine Safety Science and Engineering, Harbin, Heilongjiang, China, August 18-20, 2023.
15. **Liu, S.**, 2023. Application of a novel gas fracturing technique for coal. North American Coalbed Methane Forum, Pittsburgh, PA, USA, April 13, 2023.
16. **Liu, S.**, 2023. Carbon sequestration in deep coal: hydrogen production by underground combustion of coal. North American Coalbed Methane Forum, Pittsburgh, PA, USA, April 13, 2023.
17. Fan, L., **Liu, S.**, 2021. Fluid-dependent Shear Slip Behaviors of Coal Fractures and Their Implications on Fracture Frictional Strength Reduction and Permeability. The 11th Asian Rock Mechanics, Beijing, China, October 21-24, 2021.
18. Fan, L., **Liu, S.**, Sang, G., Liu, A., Zhang, R., 2021. Moisture-induced Modulus Reduction of Roof Rocks and Its Implication on Future Mine Support Design. The 2021 International Conference on Ground Control in Mining, Canonsburg, PA, USA, July 27-29, 2021.
19. **Liu, S.**, 2021. Characterization of Nano-to-Micron Sized Respirable Coal Dust: Particle Surface Alteration and the Health Impact. The 1st International Symposium on Mine Dust and Aerosol Research (ISMDAR), Virtual, University Park, PA November 15-16.
20. **Liu, S.**, 2020. Keynote Speaker. Micropore dilation and its enhancement of gas diffusion through waterless cryogenic treatment. International Webinar on Frontiers in Mining & Geosciences with special focus on Remote Sensing, Geotechnics, Mine Planning & Operation, Virtual, November 7-8.
21. **Liu, S.**, Xiao, M., Liew, M., and Salam, S., 2020. Keynote Speaker. Geotechnical properties and liquefaction potential of coal tailings evaluated using multichannel analysis of surface waves, seismic refraction and seismic monitoring. Re:Con 2020 – Conference for Managing Blasting Risk, Key West, FL, USA, 12-15 January 2020.
22. **Liu, S**., 2019. Keynote Speaker. Micromechanics of coal and shale under various loading condition. 6th International Conference on Unconventional Geomechanics, Beijing, China, October 11-13, 2019
23. **Liu, S**., 2019. Keynote Speaker. Stress depletion behavior with continuous gas extraction of CBM reservoir. Subsurface Unconventional Energy Extraction Technology Summit, Jiaozuo, Henan, China, October 17-20, 2019
24. Zhang, R., and **Liu, S**., 2019. Alteration of shale anisotropic pores under uniaxial compression condition: An investigation using small-angle neutron scattering. AGU Fall Meeting, San Francisco, CA, USA, December 9-13, 2019. Poster H33N-2173.
25. Sang, G., **Liu, S**., Elsworth, D., and Zhang, R., 2019. Water Vapor Condensing in Anisotropic Pores of Shales by Neutron Scattering. 2019 AAPG Eastern Section Meeting: Energy from the Heartland, Columbus, Ohio, USA, October 12-16, 2019.
26. Zhang, R., and **Liu, S**., 2018. Gas densification and adsorption in rock nanopores. International Small-Angle Scattering Conference, Traverse City, MI, US, October 7-12, 2018
27. Zhang, R., **Liu, S**., Chen, Y., Elsworth, D., Feng, Z., Zhao, X., and An, K., 2018. Investigation of shale matrix heterogeneity, anisotropy and strain using X-ray and in-situ neutron diffraction. Goldschmidt Conference, Boston, MA, US, August 12-17, 2018
28. Zhang, R., **Liu, S**. and He, L., 2018. Observation of anisotropic nanoscale accessible pore structure for anthracite and shale using small-angle neutron scattering. American Conference on Neutron Scattering, College Park, MD, US, June 24-28, 2018
29. Chakraborty, N., Karpyn, Z., **Liu, S**. and Yoon, H., 2018. Experimental evidence of gas storage and phase densification in ultra-tight shale. Gordon Research Conference on Flow & Transport In Permeable Media, Newry, ME, US, July 8-13, 2018
30. **Liu, S.**, 2018. Gas sorption, diffusion and permeability behaviors for Marcellus shale and their impacts on long-term well production. International Workshop on l Geomechanics of Shale Gas and Energy Storage, Wuhan, China, May 15-17, 2018
31. **Liu, S.**, 2016. In situ stress evolution with continuous gas depletion in coalbed methane reservoirs and its implication on permeability and production. 3rd International Symposium on Unconventional Geomechanics, Wuhan, China, May 21-22, 2016
32. **Liu, S.**, 2015. A study of gas adsorption and transport in ultra-tight shale using neutron scattering and *in-situ* experimentation. AAPG/SEG International Conference & Exhibition, Melbourne, Australia, September 13-16, 2015
33. **Liu, S.**, 2015. Gas flow and geomechanics in coal: A multiscale and multiphysics approach, International Workshop on Coal Mine Safety, Wollongong, Australia, September 11-12, 2015
34. **Liu, S.**, 2015. Apparent permeability variation for stressed shale with sorbing gas injection. China Shale Gas Conference, Wuhan, China, September 6-8, 2015
35. **Liu, S.**, and Wang, Y., 2015. Shale core apparent permeability characterization with CO2 injection under stress-controlled condition. 14th Annual Carbon Capture, Utilization & Storage Conference, Pittsburgh, PA, USA, April 28-May 1, 2015.
36. **Liu, S.**, 2014. Keynote speaker. Compressibility of coal and its implication in coalbed methane development, 2014 ISRM Conference on Soft Rocks, Beijing, China, 6-7 June, 2014.
37. **Liu, S.**, and Harpalani, S., 2009. Measurement of cleat and matrix shrinkage compressibilities under best field replicated conditions, 2009 Asia Pacific Coalbed Methane Symposium, Xuzhou, Jiangsu, China, September 24-26.
38. Harpalani, S., and **Liu, S.**, and Mitra, A., 2009. Evaluation of critical flow parameters for CBM modeling under stress/strain-controlled condition, 2009 International Coalbed Methane & Shale Gas Symposium, Tuscaloosa, Alabama, USA, May 18-22.

**COMPLETED AND CURRENT PROJECTS**

**A. Current:**

*External Research Grants*

1. PI of Department of Energy of Energy - The Advanced Research Projects Agency-Energy (DOE ARPA-E) funding “Developing an Integrated Technology for Subsurface Hydrogen Harvesting through Reservoir Creation and Management.” 06/14/2024 to 6/13/2026, total funding: $1,2000,000. Co-PIs: Dr. Derek Elsworth and Dr. And Liu (PSU), Dr. Satya Harpalani (SIUC) and Dr. Divya Prakash (SIUC).
2. Co-PI of CDC – The National Institute for Occupational Safety and Health (CDC-NIOSH) funding “Designing a Safe Electrification System for Smart Mines Through Ventilation Modeling, Monitoring, Control, and Training.” 09/30/2024 to 9/29/2029, total funding: $1,249,350. PI: Dr. Ashish Kumar, Dr. Sekhar Bhattacharyya, Dr. Ang Liu, and Dr. Satadru Dey (PSU)
3. Co-PI of US Department of Labor - Mine Safety and Health Administration (DOL-MSHA) funding “Development of Respirable Crystalline Silica Training Modules.” 12/01/2024 to 11/30/2025, total funding: $149,465. PI: Dr. Ashish Kumar, Dr. Sekhar Bhattacharyya, Dr. Barbara Arnold, and Dr. David Varney (PSU)
4. Co-PI of Industry funding from Chevron USA Inc “Dynamic gas-release fracturing of reservoir rocks to increase permeability.” 10/01/2024 to 12/31/2024, total funding: $50,000. PI: Dr. Derek Elsworth (PSU).
5. PI of Industry funding from UNGES LLC “ARSO: Rock Mechanics Tests for External Partners.” 8/13/2024 to 12/31/2025, total funding: $9,775.

*Internal Research Grants (None)*

**B. Completed**

1. Co-PI of CDC – The National Institute for Occupational Safety and Health (CDC-NIOSH) funding “Understanding and Design of Ventilation Systems and Their Optimization for Large Opening Underground Mines.” 09/01/2019 to 8/31/2024, total funding: $1,250,000. PI: Dr. Sekhar Bhattacharyya and Dr. Derek Elsworth (PSU)
2. Co-PI of Department of Energy funding “Consortium to Assess Northern Appalachia Resource Yield (CANARY) of CORE-CM for Advanced Materials.” 10/01/2021 to 12/31/2024, total funding: $1,764,129. PI: Dr. Sarma Pisupati, Dr. Barbara Arnold, Dr. Jonathan Mathews, Dr. Meng Wang, Dr. David Yoxtheimer, Dr. Maurie Kelly, Dr. James Spayd, Dr. Sekhar Bhattacharyya, and Dr. Bernd Haupt (PSU)
3. PI of CDC – The National Institute for Occupational Safety and Health (CDC-NIOSH) funding “Characterization of Submicron-/Nano-scale Coal Dusts and Their Effects on Miners’ Pneumoconiosis and Lung Cancer for Underground Coal Mines.” 09/01/2019 to 8/31/2022, total funding: $400,000. Co-PIs: Dr. Sekhar Bhattacharyya (PSU) and Dr. Siyang Zheng (CMU)
4. PI of Alpha Foundation for the Improvement of Mine Safety and Health, Inc. funding “Control of Hazardous Gas Emissions to Longwall Face and Bleeder System: Laboratory Experiments, Modeling and Field Monitoring.” 07/01/2018 to 12/31/2019, total funding: $250,000. Co-PIs: Dr. Derek Elsworth (PSU) and Satya Harpalani (SIUC)
5. Sole-PI of Society for Mining, Metallurgy and Exploration (SME) funding “The 2017 Freeport-McMoRan Career Development Grants.” Funded by SME, 08/15/2017 to 08/14/2020, total funding: up to $300,000.
6. PI of CDC – The National Institute for Occupational Safety and Health (CDC-NIOSH) funding “Building Capacity and Enhancing Long-Term Coal Mine Weak Roof Stability through Characterization and Modeling of Time-Dependent and Moisture-Sensitive Shale Rock Failures.” Funded by NIOSH (2016-N-17733), 09/01/2016 to 08/31/2021, total funding: $1,346,522. Co-PIs: Drs. Derek Elsworth (PSU)
7. PI of IEE funding “Experiment and Modeling of Multi-physics Gas Flow Dynamics through Multi-Scale Shale Pores.” Funded by Penn State Institutes of Energy and the Environment, 03/15/2018 to 06/30/2019, total funding: $25,000. Co-PIs: Drs. Zi-Kui Liu, Shun-Li Shang, Ming Xiao (PSU) and Dr. Lilin He (ORNL).
8. PI of Penn State Human Health and the Environment funding “Investigating the Effect of Nano-Coal-Dusts on Worker’s Health and Its implications on Pneumoconiosis and Lung Cancer.” Funded by Penn State HHE seed grant, 07/01/2018 to 06/30/2020, total funding: $50,000. Co-PIs: Drs. Siyang Zheng, Zhiwen Liu, Chandra Belani (PSU) and Dr. Lilin He (ORNL).
9. Co-PI of United States Department of the Interior – Office of Surface Mine (OSM) funding “Field investigation and stability analysis of coal slurry impoundments.” Funded by OSM (S16AC20074), 10/01/2016 to 09/30/2019, total funding: $200,000. PI(s): Dr. Ming Xiao (PSU)
10. Co-PI of DOE National Energy Technology Laboratory funding “A Scaling Study of Microbially-Enhanced Methane Production from Coal (MECBM): Optimizing Nutrient Delivery for Maximized Methane Production.” 10/01/2015 to 06/30/2018, total funding: $564,201. PI: Dr. Derek Elsworth (PSU)
11. Co-PI of Alpha Foundation for the Improvement of Mine Safety and Health, Inc. funding “Development of Guidance for the Selection and Use of Atmospheric Monitoring Systems to Improve Decision-making during Routine and Post-accident Operations.” 09/01/2015 to 07/31/2019, total funding: $588,213. PI: Dr. Jeffery Kohler (PSU)
12. Co-PI of DOE Sandia National Laboratories funding “Shale Poromechanics: Heterogeneity, Flow, Failure and Creep.” 10/01/2014 to 09/30/2018, total funding: $480,508. PI: Dr. Zuleima Karpyn (PSU)
13. PI of NSF funding “Characterization and Modeling of Multimechanistic Flow Behaviors from Nano- to Macro-scale in Shale Matrix.” Funded by NSF CBET Fluid Dynamics program (CBET 1438398), 07/01/2014 to 06/30/2018, total funding: $330,000. Co-PIs: Drs. Derek Elsworth and Ming Xiao (PSU)
14. Single PI of an industrial funding “Water Sensitive Rock Core Swelling Investigation”, funded by DZL Corporation, 01/01/2017 to 12/31/2017, total funding: $11,200.
15. Single PI of an industrial funding “Dulles Corridor Metrorail – Rock Mechanics Tests”, funded by Schnabel Engineering, LLC, 07/01/2016 to 01/31/2017, total funding: $1,520.
16. Single PI of an industrial funding “ReWa Conveyance Tunnel Project – Rock Mechanics Tests”, funded by Bunnell-Lammons Engineering, Inc, 07/01/2016 to 01/31/2017, total funding: $9,600.
17. Single PI of an industrial funding “Three River Protection Overflow Reduction Tunnel System (3RPORT – P2)”, funded by 7NT Engineering and Testing, 07/01/2016 to 01/31/2017, total funding: $10,800.
18. PI of PSIEE funding “Investigation of Flow Behaviors in Shales during Primary Gas Depletion and CO2 Sequestration.” Funded by Penn State Institutes of Energy and the Environment, 03/15/2014 to 06/30/2015, total funding: $25,000. Co-PIs: Drs. Derek Elsworth and Ming Xiao (PSU)
19. Single PI of Gladys Snyder funding “Coal Mine Gas: Clean Energy for the World; Research and Education.” Funded by Penn State – College of Earth and Mineral Sciences, 01/01/2015 to 12/31/2015, total funding: $5,000.
20. Single PI of Wilson Research Initiation Grant “Analysis of Production Induced Stress Changes and Its Implications for Seismicity during Gas Shale Production.” Funded by Penn State – College of Earth and Mineral Sciences, 07/01/2013 to 06/30/2014, total funding: $10,000.
21. Single PI of Open Research Project funding “The Dynamic Strength change of Coal in Sorbing Gases Environment under Dynamic Stressing Condition.” Funded by State Key Laboratory of Coal Resources and Safe Mining, China (SKLCRSM13KFA01), 01/01/2014 to 12/31/2015, total funding: $15,000.

**INVITED TALKS**

1. “Mine Roof Deteriorations and Their Implications on Time Dependent Long Term Mine Roof Stability”, 3rd International Symposium on In-situ Modification of Deposit Properties for Improving Mining 2022 (IMDPIM2022), Virtual, August 12-14, 2022, Taiyuan, Shanxi, China.
2. “Mining and Mineral Engineering Research & High Impact Publishing in International Journal of Coal Science & Technology”, Colorado School of Mines, Mining Engineering Seminar, Virtual, April 28th, 2021.
3. “Anisotropy of Nanoscale Pore Deformations of Coal and Shale under Far-Field Uniaxial Stress Conditions”, University of Queensland, Virtual, June 10, 2021.
4. “Hydrogen Sorption and Diffusion in Coal”, 11th Asian Rock Mechanics Symposium, Challenges and Opportunities in Rock Mechanics, Virtual, October. 21-25, 2021.
5. “Size-reduction Induced Coal Dust Surface Alteration and its Potential Health Impact”, 2021 Fall Workshop of the Air-Microfluidic Group (AMFG), University of Illinois - Chicago, November 18, 2021.
6. “Study of Localized Coal Failure in Sorbing Gas Environment and its Application for Understanding Coal-Gas Outburst Mechanisms”, State Key Laboratory of Coal Mine Disaster and Control, Chongqing University, November 22, 2021.
7. “Characterizing Water-Mudstone Interaction Behaviors and Their Implications on Time-Dependent Mechanical Reduction and Long-Term Mine Roof Stability”, The Technische Universität Bergakademie Freiberg, Seminar at Faculty of Geosciences, Geoengineering and Mining, November 29, 2021.
8. “Characterization of Submicron-/Nano-scale Coal Dusts and Their Effects on Miners’ Pneumoconiosis for Miners”, 2nd International Symposium on In-situ Modification of Deposit Properties for Improving Mining 2020 (IMDPIM2) and 7th International Symposium on Unconventional Geomechanics (UG7), Virtual, November 7-8, Taiyuan, Shanxi, China.
9. “Predicting Fugitive Gas Emissions from Gob-to-Face in Longwall Coal Mines: Coupled Analytical and Numerical Modeling”, PCMIA Joint Virtual Webinar Series, December 17, 2020
10. “Microscale Gas Transport and Its Implication on the Production for Marcellus Shales”, Saint Francis University, Loretto, PA, USA, April 6, 2018.
11. “Fracked gas shale well flowback water analysis and its implication on reservoir property estimations”, Jianghan Oil Company, Sinopec, Fuling, China, January, 2017.
12. “Flow and geomechanics behaviors of coalbed methane reservoir under *in situ* condition”, Henan Polytechnic University, Jiaozuo, China, July, 2016.
13. “Complex gas flow dynamics in coal and its implication on mine gas control”, Anhui University of Science and Technology, Huainan, China, July, 2016.
14. “A multiscale and multiphysics gas flow and geomechanics in coalbed methane reservoirs - how laboratory research and modeling add values to cbm exploration and production”, PetroChina Coalbed Methane Company Limited, Beijing, China, July, 2016.
15. “Flowback data analysis for stimulated shale wells and its implication on evaluation of stimulation effectiveness”, Sinopec Tech Houston, Houston, TX, USA, June 27, 2016.
16. “Coal-Bio-Gasification – Geomechanics and best practice for reservoir stimulation”, Shanxi Lanyan Coalbed Methane Co Ltd, Jinchen, Shanxi, China, May 26-27, 2016.
17. “A multi-laboratory evaluation of micro-scale gas matrix interactions and its impact on gas transport and mechanical properties”, Institute of Rock and Soil Mechanics, Chinese Academy of Sciences, Wuhan, China, May 20, 2016.
18. “CBM well gas production optimization: well stimulation and secondary enhancement”, PetroChina Huabei Oilfield Company, Renqiu, China, May, 2016.
19. “Gas dynamics in ultra-tight shales and its implication of gas production”, School of Safety Engineering, China University of Mining and Technology, Xuzhou, China, June 22, 2015.
20. “Multiscale and multimechanistic flows in tight shales”, The State Key Laboratory of Nonlinear Mechanics, Chinese Academy of Sciences, Beijing, China, June 18, 2015.
21. “Intricacies of flows in shale rocks”, Department of Industrial & Systems Engineering, Rutgers, The University of New Jersey, New Brunswick, NJ, March 10, 2015.
22. “Flow behaviors in unconventional reservoirs and geomechanical responses with depletion”, Battelle-NETL R&D Potential Collaboration Meeting, Energy Institute, Penn State University, University Park, PA, August 19, 2014.
23. “Flow and geomechanics behaviors of coalbed methane reservoir under in situ conditions”, State Key Laboratory of Coal Resources and Safe Mining, China University of Mining and Technology, Beijing, China, June 9, 2014.
24. “Coalbed methane – nightmare for coal miners, clean energy for the world”, Workshop for Coal-Mining Safety, National Engineering Research Center of Coal Gas Control, China University of Mining and Technology, Xuzhou, Jiangsu, China, May 27, 2014.
25. “Coalbed methane exploration and related research”, Graduate seminar, Department of Energy and Mineral Engineering, Penn State University, State College, PA, April, 24, 2014
26. “Coal mine methane (CMM), coalbed methane (CBM) and shale gas development” invited presentation for delegation of State of Administration of Coal Mine Safety (SACMS) P.R. of China, 2013.

**SERVICE to Discipline and Profession**

1. Co-Chair of the 20th North American Mine Ventilation Symposium (NAMVS), Society for Mining, Metallurgy & Exploration, June 21-26, 2025, Pittsburg, PA, USA.
2. Chair of 7th International Symposium on Mine Safety Science and Engineering (ISMSSE 2024), ICMSSE, August 17-21, 2024.
3. Co-Chair of International Symposium on Mine Dust and Aerosol Research (ISMDAR), October13-14, Hefei, China, 2024.
4. Co-Chair of ISRM sponsored Workshop on Sorptive Rocks Mechanism and Engineering (ISMDAR), August 13-14, Beijing, China, 2023.
5. Invited Reviewer for the National Institute for Occupational Safety and Health (NIOSH) Alice Hamilton Awards for Excellence in Occupational Safety and Health, 2022, 2023, 2024
6. President of ISRM Sorptive Rocks and Engineering Commission, 2021-present.
7. Member of Technical committee, 18th North American Mine Ventilation Symposium (NAMVS), Society for Mining, Metallurgy & Exploration, 2020-2021.
8. Thesis Examination for Indian Institute of Technology

* Ph.D. Thesis Evaluation, IIT-Dhanbad, 2020

1. Invited Reviewer and Panel for The Canada First Research Excellence Fund (CFREF), 2020
2. Invited Reviewer and Panel for The Canada Foundation for Innovation, 2020
3. Thesis Examination for Australian Universities

* Patrick Booth, Ph.D. Thesis Evaluation, University of Wollongong, 2019
* Ph.D. Thesis Evaluation, Curtin University, 2019

1. Organizer for Coal, CBM and Gas Hydrate Geomechanics sessions in 53rd US Rock Mechanics/Geomechanics Symposium at New York City, US, June 23-26, 2019.
2. Member of Scientific Committee for International Conference of Innovative Mining Technologies , Poziomkowa, Poland, March 25-27, 2019
3. Editor-in-Chief, International Journal of Coal Science and Technology, Springer, 2019-present
4. Scientific Editor for Earth and Environmental Sciences, Nature Scientific Report, Springer, May 2018-present
5. Scientific Editor, Journal of Rock Mechanics and Geotechnical Engineering, Elsevier, 2018-present
6. Guest Editor, Advances in Materials Science and Engineering: Special Issue on Advances in Modeling of Heat and Mass Transfer in Porous Materials, 2018.
7. Organizer for International Workshop on Geomechanics of Shale Gas and Energy Storage at Wuhan, China, May 15-17, 2018.
8. Invited Reviewer for UK NERC, 2017
9. Organizer for International Workshop on Grand Challenges in Mining Engineering at Beijing, China, June 19-22, 2017.
10. Invited Reviewer for German Research Foundation (DFG), 2016
11. Organizer for International Workshop on Coal Mine Safety at Wollongong, Australia, September 2015
12. Treasurer, Central PA Subsection of Society for Mining, Metallurgy & Exploration (SME), 2016 to 2019.
13. NSF Panelist for CBET – Fluid Dynamic Program, 2015
14. Invited proposal reviewer for American Chemical Society Petroleum Research Fund, Summer 2014.
15. Guest Editor, Shock and Vibration: Special Issue on Shock and Vibration Induced by Mining Extraction, 2014-2015, 2015-2016.
16. Memberships

* Society for Mining, Metallurgy & Exploration (SME), Member: 2007-Present.
* American Association Petroleum Geologists, member: 2015-present.
* American Rock Mechanics Association, Lifetime member
* International Society for Rock Mechanics, Lifetime member
* The Society of Core Analysts, Lifetime member

1. Record of pursuit of advanced degrees and/or further studies

* 2-day short course on “Shale gas geoengineering”, American Rock Mechanics Association (ARMA), Houston, TX, USA. By Professor Maurice B. Dusseault, University of Waterloo, Canada (June 2016)
* ABET Workshops at Penn State University

1. Workshop 1, “Learning ABET Accreditation.” by Jenny Amos, UIUC (May 2015)
2. Workshop 2, “ABET Data Collection and Compilation.” by Thomas Litzinger, Penn State (June 2015)
3. Workshop 3, “ABET Common Problems – Common Solutions.” by Thomas Litzinger, Penn State (July 2015)

* Computer modeling group, Ltd. “2-day training course on CMG simulation for coalbed methane and gas shale reservoirs.” By Anjani Kumar (June 2011)

1. Reviewer for professional journals:

International Journal of Coal Geology, Energy & Fuels, International Journal of Greenhouse Gas Control, International Journal of Rock Mechanics and Mining Sciences, Fuel, International Journal of Coal Preparation and Utilization, Energy Exploration and Exploitation, Greenhouse Gas Measurement & Management, Fluid Phase Equilibria, SPE Journal, Journal of Natural Gas Science & Engineering, Natural Hazard, International Journal of Oil, Gas and Coal Technology, Arabian Journal of Geosciences, Engineering Failure Analysis, The Journal of Unconventional Oil and Gas Resources, Journal of Energy Chemistry, Greenhouse Gases: Science and Technology, Tunneling and Underground Space Technology, International Journal of Coal Science & Technology, ASTM Journal of Testing and Evaluation, Mining Engineering Magazine, Fuel Processing Technology, Journal of Geotechnical and Geoenvironmental Engineering, Rock Mechanics and Rock Engineering, Transport in Porous Media, Journal of Geophysical Research – Solid Earth, Environmental Science & Technology, ACS-Omega, Journal of CO2 Utilization, Nature – Scientific Reports, Colloids and Surfaces A: Physicochemical and Engineering Aspects, Process Safety and Environmental Protection,

1. Conference Session Chair:

* 53rd US Rock Mechanics/Geomechanics Symposium, New York City, US, June 23-26, 2019.
* China Shale Gas Conference 2015, Wuhan, China, September 6-8, 2015
* 14th International Conference on Coal Science & Technology, State College, PA, Sept. 29-Oct. 3, 2013.

**SERVICE to the University and Society**

1. Chair of Committee on EMS Evan Pugh Professor Nomination, 2023
2. IEE Seed Grant Review Panel, 2021
3. Chair of Graduate Admission Committee, 2020-2021
4. Member of Strategic Planning Committee for EMS Energy Institute, 2020
5. Chair of Search Committee for Professor in Practice in Mining Engineering (Spring 2020).
6. Chair of Search Committee for Mining Engineering Chair (Spring 2019).
7. Member of Search Committee for Mining Engineering Instructor (2019).
8. Chair of Departmental Lab and Space Committee (Fall 2018-Summer 2019)
9. Member of the EME P&T Committee, 2018-2019, 2022-2024
10. Member of the Water Research and Education at Penn State (WREAPS) Committee, 2017
11. Member of Efficient Teaching Committee, 2017
12. Member of Faculty Activity Analysis Committee, 2017, 2018
13. Member of Hosler Building Renovation Committee, 2015-2016
14. Penn State Institutes of Energy & the Environment Seed Grant Panelist, 2015
15. Member of Search Committee for The Geoge H. and Anne B. Deike Endowed Chair in Mining Engineering (Fall 2013 - Spring 2014).
16. Faculty advisor for Mine Mucking Student Club (supervise and train the team members for the Annual International Collegiate Mining Competition).
17. Faculty advisor for Student Mine Rescue Team (train and assist student team for national and regional mine rescue contests)
18. Member of Graduate committee of the EME department.

Department of Energy and Mineral Engineering/College of Earth and Mineral Sciences