ASHISH RANJAN KUMAR, Ph.D., P.E.

Assistant Professor, Mining Engineering

121 Hosler Building, Department of Energy and Mineral Engineering
College of Earth and Mineral Sciences
The Pennsylvania State University, State College, PA 16802
Email: awk5528@psu.edu, Phone: 814 863 4771
Google Scholar

EDUCATION

Dec 2018	Ph.D., Mining Engineering, University of Kentucky, Lexington, KY
Dec 2015	M.S., Mining Engineering, University of Kentucky, Lexington, KY
May 2010	B.Tech, Mining Engineering, Indian School of Mines, Dhanbad

ACADEMIC APPOINTMENTS

2022 - present	Assistant Professor, Department of Energy and Mineral Engineering, Penn State University, State College, PA
2022	Assistant Research Professor, Department of Mining Engineering, Missouri University of Science and Technology, Rolla, MO
2020 - 2021	Post-doctoral Fellow, Department of Mining Engineering, Missouri University of Science and Technology, Rolla, MO
2018 - 2020	Post-doctoral Scholar, Department of Mining Engineering, University of Kentucky, Lexington, KY

RESEARCH EXPERIENCE

2013 - 2018	Graduate Research Assistant, Department of Mining Engineering, University of Kentucky, Lexington, KY
2010	Summer Research Project Fellow, Geological Oceanographic Division, National Institute of Oceanography, India
2009 - 2010	Undergraduate Research Assistant, Indian School of Mines, Dhanbad

COURSES TAUGHT

Fall 2023 (PSU)	Special Topics (MNG 497-001), Process Automation and Control (EME 597-002), Energy Systems Automation (MNG 497-002)
Fall 2022 (PSU)	Underground Mining (MNG 410-001), Special Topics (MNG 497 B)
Spring 2022/ 2021 (MST)	Surface Mine Design (MINE 6936), Surface Mining Methods (MINE 5933), Capstone Senior Design Project (MINE 4097)
Fall 2021/ 2020 (MST)	Material Handling in Mines (MIN ENG 3912), Mine Power and Drainage (MIN ENG 5912), Underground Mining Methods (MIN ENG 5932)

INDUSTRY EXPERIENCE

2010 - 2013	Assistant Manager / Graduate Engineering Trainee (Mine operations and and technical services), Sasan Power Limited, Reliance Power, India
2009	Summer Intern, Bharat Coking Coal Limited, Coal India Ltd.
2008	Summer Intern, Rajhara mechanized mine, Steel Authority of India Ltd.
2007	Summer Intern, West Bokaro collieries, TATA Steel

PROFESSIONAL LICENSES

1. Professional Engineer, Mining and Mineral Processing, Kentucky State Board of Licensure for Professional Engineers & Land Surveyors
2. Energy Risk Professional - Level I, Global Association of Risk Professionals

PATENTS

1. Schafrik, S. J., Kumar, A. R. and Taylor, A., University of Kentucky Research Foundation, 2022. Efficient non-clogging inertial vortex type particle scrubber. U.S. Patent 11,338,232.
2. Kumar, A. R., Schafrik, S., Wedding, W. C. and Velasquez, O., University of Kentucky Research Foundation, 2021. Filter assembly and scrubber section for a continuous miner. U.S. Patent 11,207,627.

PEER-REVIEWED JOURNAL PUBLICATIONS

1. Amoah, N. A., Xu, G., Kumar, A. R., and Wang, Y., 2023. Calibration of low-cost particulate matter sensors for coal dust monitoring. *Science of the Total Environment*, 859(2).
2. Kumar, A. R., Gupta, N. and Schafrik, S., 2022. CFD modeling and laboratory studies of dust cleaning efficacy of an efficient four stage non-clogging impingement filter for flooded-bed dust scrubbers. *International Journal of Coal Science and Technology*, 9(16).
3. Gupta, N., Kumar, A. R., and Schafrik, S., 2021. Laboratory determination of coal dust cleaning efficacy of a fibrous filter for flooded-bed dust scrubber. *Minerals*, 11(3), p. 295.
4. Kumar, A. R., Schafrik, S. and Velasquez, O., 2020. Designing, Modeling, and Laboratory Testing of a Non-clogging Impingement Type Filter for Mining Dust Scrubbers. *Mining, Metallurgy & Exploration*, 37, pp.1911–1918.
5. Kumar, A. R. and Schafrik, S., 2020. Multiphase CFD modeling and laboratory testing of a Vortecone for mining and industrial dust scrubbing applications. *Process Safety and Environmental Protection*, 144, pp.330-336.
6. Kumar, A. R., Schafrik, S. and Novak, T., 2020. Multi phase computer modeling and laboratory study of dust capture by an inertial Vortecone scrubber. *International Journal of Mining Science and Technology*, 30(3), pp.287-291.
7. Kumar, A. R., Levy, A., Kumar, A., Schafrik, S. and Novak, T., 2020. Computational fluid dynamics modeling and laboratory analysis of aerosol particles' capture on thin swirling water film in a Vortecone. *Powder Technology*, 361, pp.499-506.
8. Kumar, A. R., Arya, S., Levy, A., Schafrik, S., Wedding, W. C., and Saito, K., 2020. Scale and numerical modeling to determine operating points of a non-clogging Vortecone filter in mining operation. *Progress in Scale Modeling*, 1(1), pp.43-50.
9. Arya, S., Kumar, A. R., Saito, K., Novak, T., and Levy, A. 2020. Scale modeling of dust capture through a flooded-bed dust scrubber integrated within a longwall shearer. *Progress in Scale Modeling*, 1(1), pp.35-42.

PEER-REVIEWED CONFERENCE PROCEEDINGS

1. Oluwafemi, S., Xu, G., Kumar, A. R., Pushparaj, R. I., and Iqbal, A., 2023. Fire-induced temperature attenuation under the influence of a single ceiling smoke extraction point in a mine drift. In *North American Mine Ventilation Symposium* (Preprint). Rapid City, SD.
2. Amoah, N., Kumar, A. R., and Xu, G., 2023. Parametric studies to maximize rge dust protection performance of the two-level manifold canopy air curtain and computational fluid dynamics modeling. In *North American Mine Ventilation Symposium* (Preprint). Rapid City, SD.
3. Kumar, A. R., Henderson, K. M., and Schafrik, S., 2021. Scale modeling, PIV, and LES of blowing type airflow in a deep cut continuous coal mining section. In *Mine Ventilation* (pp. 65-74). CRC Press.
4. Taylor, A., Schafrik, S., and Kumar, A. R., 2019. The Vortecone: A new maintenance free wet-scrubber device. *International Future Mining Conference.* Sydney, NSW, Australia.
5. Srivastava, V., & Kumar, A. R. (2019). A critical review of best practices of reclamation from large surface mining operations. *National Conference on Recent Advances in Mining Technology.* Bangalore, India.
6. Kumar, A. R., Levy, A., Wedding, W. C., Saito, K., and Novak, T., 2017. Numerical scaling of operations of a Vortecone scrubber using computational fluid dynamics modeling and laboratory experiments. *8th International Symposium on Scale Modeling.* Portland, OR.
7. Kumar, A. R., Arya, S., Wedding, W. C., and Novak, T., 2017. Examination of capture efficacies of a shearer mounted flooded-bed dust scrubber using experiments and computational fluid dynamics (CFD) modeling on a reduced scaled model. *16th North American Mine Ventilation Symposium.* (Preprint 20-1, 8p). Denver, CO.
8. Arya, S., Wedding, W. C., Novak, T., Kumar, A. R. and Levy, A., 2017. Pressure drop measurement across flooded-bed scrubber screen and demister in a laboratory setup for its use in a longwall shearer. *16th North American Mine Ventilation Symposium.* (Preprint 15-1,8p). Denver, CO.
9. Wedding, W. C., Novak, T., Arya, S., and Kumar, A. R., 2015. CFD modeling of a flooded-bed scrubber concept for a longwall shearer operating in a U.S. coal seam. *15th North American Mine Ventilation Symposium.* 385-390. Blacksburg, VA.

CONFERENCE PROCEEDINGS REVIEWED BY ABSTRACT

1. Amoah, N., Kumar, A., and Xu, G., 2022. Calibration of low-cost particulate matter sensors for coal dust monitoring. *SME Annual Conference and Expo.* (Preprint). Salt Lake City, UT, Society for Mining, Metallurgy & Exploration.
2. Amoah, N., Kumar, A., and Xu, G., 2022. Improved canopy air curtain dust protection using a novel design combining the impinging jet and a two-level manifold. *SME Annual Conference and Expo.* (Preprint). Salt Lake City, UT, Society for Mining, Metallurgy & Exploration.
3. Kumar, A. R., Kumar, A., and Schafrik, S., 2019. CFD modeling of dust transportation and deposition under Newtonian forces in the reduced scale model of a typical room and pillar mine. *SME Annual Conference and Expo and CMA 121st National Western Mining Conference.* (Preprint). Denver, CO, Society for Mining, Metallurgy & Exploration.
4. Kumar, A., Schafrik, S., and Kumar, A. R. ,2019. Float coal dust sampling and preliminary thermogravimetric analysis. *SME Annual Conference and Expo and CMA 121st National*

Western Mining Conference. (Preprint). Denver, CO, Society for Mining, Metallurgy & Exploration.

5. Kumar, A. R., Velasquez, O. A., Schafrik, S., and Wedding, W. C., 2018. Computational fluid dynamics (CFD) modeling of free-surfaces and particle capture in a vortecone scrubber system scaled for installation on continuous miners. *SME Annual Conference and Expo and 91st Annual Meeting of the SME-MN Section.* (Preprint 18-102, 5p). Minneapolis, MN, Society for Mining, Metallurgy & Exploration.
6. Velasquez, O., Kumar, A. R., Schafrik, S., and Wedding, W. C., 2018. Computational fluid dynamics modeling of dust capture by a non-clogging screen system for a flooded-bed dust scrubber. *SME Annual Conference and Expo.* (Preprint 18-077, 4p). Minneapolis, MN, Society for Mining, Metallurgy & Exploration.
7. Kumar, A. R., Wedding, W. C., Jolly, A., Arya, S., and Novak, T., 2016. Modeling capture efficiency for a flooded-bed dust scrubber incorporated into a longwall shearer using a small scale physical model and CFD. *SME Annual Conference and Expo.* (Preprint 16-118, 3p). Phoenix, AZ, Society for Mining, Metallurgy & Exploration.
8. Arya, S., Wedding, W. C., Kumar, A. R., and Novak, T., 2016. CFD modeling of a novel wet scrubber for the capture of respirable dust in an underground coal mine. *SME Annual Conference and Expo.* (Preprint 16-161, 4p.) Phoenix, AZ, Society for Mining, Metallurgy & Exploration.
9. Kumar, A. R. and Gupta, N., 2008. Role of blast-fragmentation towards proper selection of crushers. *National Seminar on Crushing, Screening, and Conveying.* Dhanbad, India, Department of Mechanical and Mining Machinery Engineering, Indian School of Mines.

OTHER PROFESSIONAL PRESENTATIONS

1. Gupta, N., Kumar, A. R., and Schafrik, S., 2022. Development of a test-set up to determine dust filter cleaning efficiency assisted by CFD modeling. *SME Annual Conference and Expo.* Salt Lake City, UT.
2. Morgan, E. L., Schafrik, S. and Kumar, A. R.., 2020. Ventilation in rickhouses and the effect on corrosion. *James B. Beam Institute Industry Conference.* Feb 27$^{\text{th}}$. Lexington, KY.
3. Kumar, A. R. and Schafrik, S., 2020. CFD and scale modeling of a vortex scrubber for high airflow cleaning applications. *SME Annual Conference and Expo.* Feb 24$^{\text{th}}$. Phoenix, AZ.
4. Kumar, A., Kumar, A. R., and Schafrik, S., 2019. Computer modeling and laboratory testing of maintenance free Vortecone for dust-capture. *SME Annual Conference and Expo.* Feb 27$^{\text{th}}$. Denver, CO.
5. Kumar, A., Kumar, A. R., and Schafrik, S., 2019. Laboratory testing of a non-clogging filter screen for dust capture. *SME Annual Conference and Expo.* Feb 27$^{\text{th}}$. Denver, CO. [Poster].
6. Kumar, A., Kumar, A. R., and Schafrik, S., 2019. Computational fluid dynamics modeling and lab testing of a self-cleaning impingement filter screen. *SME Annual Conference and Expo.* Feb 27$^{\text{th}}$. Denver, CO.
7. Kumar, A. R., Schmitt, S., and Otero, J.G., 2018. Molecular scale carbon ablation in hypersonic flight. *Mechanical Engineering Graduate Students Showcase.* University of Kentucky. Nov 9$^{\text{th}}$. Lexington, KY.
8. Kumar, A. R., Velasquez, O., and Schafrik, S., 2018. Laboratory experiments to promulgate a Vortecone scrubber as an efficient dust cleaning System. *SME Annual Conference and Expo.* Feb 27$^{\text{th}}$. Minneapolis, MN.

9. Kumar, A. R., Levy, A., and Wedding, W. C., 2017. Modeling dust capture by a Vortecone scrubber: Looking at the effects of increasing size. *Joint Spring Meeting, Central Appalachian Section of SME and the West Virginia Coal Mining Institute.* Apr 8th. Lexington, KY.
10. Wedding, W. C., Kumar, A., Levy, A., & Novak, T. (2017). Coal mine dust mitigation through novel scrubber development and numerical modeling. *SME Annual Conference and Expo. NIOSH Mine Ventilation Capacity Building Review Meeting.* Feb 24th. Denver, CO.
11. Kumar, A. R., & William, W. C. (2017). Parametric study of geometry of a Vortecone scrubber for dust capture by computational fluid dynamics (CFD) modeling of multi-phase flows. *SME Annual Conference and Expo.* Feb 21st. Denver, CO. [Graduate student poster].
12. Kumar, A. R., Wedding, W. C., Arya S., & Levy, A. (2017). Computational fluid dynamics (CFD) modeling of dynamics of liquid film circulating inside a reduced scaled model of a Vortecone scrubber. *SME Annual Conference and Expo.* Feb 21st. Denver, CO.
13. Wedding, W. C., Novak, T., Kumar, A. R., & Arya, S. (2016). Coal mine dust mitigation through novel scrubber development and numerical modeling. *SME Annual Conference and Expo. NIOSH Mine Ventilation Capacity Building Meeting.* Mar 3rd. Phoenix, AZ.
14. Kumar, A. R., Wedding, W. C., & Novak, T. (2015). Analysis and evaluation of the application of a flooded-bed dust scrubber to a longwall shearer operating in a US coal seam using CFD. *SME Annual Conference and Expo.* Feb 17th. Denver, CO.
15. Kumar, A. R., & Novak, T. (2014). Application of flooded-bed dust scrubber to a longwall shearer operating in a US coal seam. *SME Bi-annual meeting, Central Appalachian Section.* Oct 24th. Lexington, KY.

CONTRIBUTIONS TO MAJOR RESEARCH PROPOSALS

1. Co-PI, co-drafted the proposal, 'Research, technology, and human interventions for self-escape in underground mine emergencies', funded by NIOSH
2. Co-PI, co-drafted the proposal, 'Interventions and communication strategies to reduce health risks of wildland fire smoke exposures', to EPA
3. Co-drafted the proposal 'Roof bolting module automation for enhancing miner safety', funded by Alpha Foundation
4. Co-PI, co-drafted the proposal, 'Maintenance free filters for continuous miner scrubber systems' funded by NIOSH
5. Drafted proposals to Alpha Foundation on the resilience of underground communication systems to explosions and to NASA on lunar dust mitigation respectively

CONTRIBUTIONS TO MAJOR RESEARCH PROJECT REPORTS

1. Contributed the CFD and scale modeling sections to the final engineering report for 'The application of flooded-bed dust scrubbers to longwall mining systems' project funded by Alpha Foundation (Contract # AFC113-10)
2. Drafted the final report of NIOSH funded research entitled 'Coal mine dust mitigation through novel scrubber development and numerical modeling' (Contract # 200-2014-59922)
3. Generated CFD models and drafted final report for the Alpha Foundation funded research project entitled 'Improved face ventilation for extended-cut continuous mining using a wing regulator and scrubber control system (Grant # AFC215-15)

SCHOLASTIC AND PROFESSIONAL HONORS

- Henry Krumb lecturer of the Society of Mining, Metallurgy, and Exploration (2019 - 2021)
- One of five graduating students awarded by the Graduate School for outstanding dissertations
- WAAIME Scholarships (2014, 2016, and 2017)
- Lewis and Elizabeth W. Young scholarship awarded by The American Institute of Mining, Metallurgical, and Petroleum Engineers (2015)
- International Society of Explosive Engineers scholarships (2014, 2015)

SYNERGISTIC ACTIVITIES

- Led the Penn State(2022) Missouri S & T teams (2021) for the NASA funded 'Break the Ice' challenge to propose methodology to extract 10,000 kg. water from lunar South pole
- Representative of 'College of Engineering & Computing' on Missouri S & T open houses
- On the technical committee of the 19^{th} North American Mine Ventilation Symposium (2021), South Dakota School of Mines and Technology
- Chaired sessions - Dust control I & II at the SME Annual Conference 2020 in Phoenix, AZ
- Young Leaders Committee (YLC) member; divisional representative of the YLC on the Coal and Energy division of SME
- Chaired a technical session on mine fans at the 15^{th} North American Mine Ventilation Symposium (2015), Virginia Tech, Blacksburg
- Reviewer of the Mining, Metallurgy & Exploration, Energies, and Minerals journals
- Member of Society of Mining, Metallurgy and Exploration (SME), American Society of Mechanical Engineers (ASME), and International Society of Explosive Engineers (ISEE)