**Xuming Wang, PhD**

**Personal Profile**

Title: Research Professor

Institution: University of Utah

Department: Materials Science and Engineering

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**Summary**

Dr. Wang’s research interest is in the area of mineral processing, coal preparation, and hydrometallurgy, including flotation separations, hydrometallurgical method for battery recycling, surface chemistry, as well as the flotation chemistry of industrial minerals and fossil energy minerals. Surface chemistry research include characterization of interfacial water and surfactant adsorption using SFG spectroscopy, FTIR and AFM. Dr. Wang serves as research leader in Dr. Miller research group and responsible for the oversight of research projects, student training, management of the laboratories, and for preparation of proposal for research funding. He has also taught mineral processing class for more than 4 years.

Dr. Wang has more than 30 years of industrial, research, and education experience, including the initial design and evaluation of new mineral processing flowsheets and reagents. He has experiences in pilot-scale operation and in-plant testing. Dr. Wang has completed a number of research projects sponsored by DOE Basic Sciences, FIPR, and NSF, as well as many industrially sponsored projects. Dr. Wang has authored or coauthored more than 80 publications and holds 15 patens. Dr. Wang was selected as SME 2013-2014 Henry Krumb Lecturer. He has received Surface Innovation Prize 2016 from Institute of Civil Engineers and has received 2018 Outstanding Reviewer Awards from Journals of *Powder Technology*, *Minerals Engineering*, *Separation and Purification Technology*, *Sustainable Materials and Technology*.

**Education Background**

* 2004, Ph.D., Metallurgical Engineering, University of Utah, Salt Lake City, Utah,

Ph.D. Dissertation: The Surface Chemistry of Phosphate Mineral Flotation with Alcoholic Solutions of Octyl Hydroxamic Acid

* 1999, M.S., Metallurgical Engineering, University of Utah, Salt Lake City, Utah
* 1982, B.S., Metallurgical Engineering, Kunming University of Science & Technology, China

**Work Experience**

* 2012-May – Current, Research Professor, Department of Metallurgical Engineering, University of Utah
* 2010 – 2012, Research Associate Professor, Department of Metallurgical Engineering, University of Utah
* 2008 – 2010, Research Assistant Professor, Department of Metallurgical Engineering, University of Utah
* 2004 – 2008, Senior Researcher/Project Manager, USG Corporation Research Center, Libertyville, IL
* 1999 – 2004, Research & Teaching Assistant, Department of Metallurgical Engineering, University of Utah
* 1996 – 1999, Project Engineer, Advanced Processing Tech., Inc., Salt Lake City, Utah
* 1994 – 1996, Research Associate, Department of Metallurgical Engineering, University of Utah
* 1984 – 1994, Senior Research Engineer, Research Institute of Chemical Mineral Resources, China
* 1982 – 1984, Processing Engineer: Handan Steel Corporation, China

**Patents and Awards**

* US Patent 10,873,106 B2: Date of Patent: Dec. 22, **2020**. J.D. Miller, X. Wang, Y. Lin, J. Liu. Composite Solid Electrolytes for Lithium Batteries.
* U-6104: Composite Solid Electrolytes for Li Batteries, J.D. Miller, X. Wang, Y. Lin, J. Liu, Nationalized PCT US, Application 16/085, 956, published 28 March **2019**.
* U-6262: Cathode for Use in a Li-Air Battery, J.D. Miller, X.Wang, Y. Lin, J. Liu, Nationalized in US, Application 16/626189, December **2019**.
* U-6496: Composite Solid Electrolyte including Li-Iron Phosphate, J.D. Miller, Q. Zhu, X. Wang, PCT/US2019/033351, Published WO2019226674, November **2019**.
* US Patent 9650305: Issued: May 16, **2017**, Hard water Foaming Agents and Methods for Gypsum Board production
* US Patent US 8871004, Issued: October 28, **2014,** Methods for Agglomerating Ores
* US Patent US 8568544, Issued: October 29, **2013**, Water resistant cementitious article and method for preparing Same
* US Patent US 8501074 B2, Issued: August 6, **2013**, Siloxane Polymerization in Wallboard
* Chinese Patent ZL201010273940. X, May 9, **2012**, Method of Producing LiCO3 from Brine Using Solar Energy
* US Patent US 8133600, Issued: March 13, 2012, Siloxane Polymerization in Wallboard
* US Patent US 8070895, Issued: December 6, **2011**, Water resistant cementitious article and method for preparing same
* US Patent US 7815730 B2, Issued: October 19, 2**010**, Siloxane polymerization in wallboard
* US Patent US 7811685, Issued: October 12, 2010, Siloxane polymerization in wallboard
* US Patent US 7803226 B2, Issued: September 28, **2010**, Siloxane polymerization in wallboard
* US Patent US 7517509, Issued: April 14, **200**9, Purification of Trona Ores by Forming a Suspension and Flotation
* US Patent US 6341697, Issued: January 29, **2002**, Selective Flotation of Phosphate Minerals with Hydroxamate

**Awards**

* 2018 Outstanding Reviewer Awards from Journals, Powder Technology, Minerals Engineering, Separation and Purification Technology, Sustainable Materials and Technologies.
* Surface Innovation Prize 2016, Institute of Civil Engineers, “Molecular Features of Water Films Created with Bubbles at Silica Surface”
* Selected as SME 2013-2014 Henry Krumb Lecturer.
* China National Science and Technology Achievement Award, Second Place on “Flotation Chemistry of Sillimanite Flotation in Alkaline Solution”, 1994

**Professional Membership**

* Member of Society for Mining, Metallurgical Exploration (SME)
* Member of Material Research Society (MRS)
* Member of Association of Chinese Science and Engineers of USA
* Life-time Member of Chinese Association of Science & Technology of US (CAST in US)

**SELECTED PUBLICATIONS**

1. Jiaqi Jin, Pranay Asai, Xuming Wang, Jan D. Miller, Milind Deo. **2021**. Simulation and analysis of slip flow of water at hydrophobic silica surfaces of nanometer slit pores. Colloids and Surfaces A: Physicochemical and Engineering Aspects 626 (2021) 127032. <https://doi.org/10.1016/j.colsurfa.2021.127032>.
2. Chen Zhang, Xuming Wang, Jiaqi Jin, Lixia Li, and Jan D. Miller. **2021**. AFM Slip Length Measurements for Water at Selected Phyllosilicate Surfaces. Colloids Interfaces2021,5,44. https://doi.org/ 10.3390/colloids5040044.
3. Lei Pan, Sean Golden, Shoeleh Assemi, Marc Freddy Sime, Xuming Wang , Yuesheng Gao and Jan Miller. **2021**. Characterization of Particle Size and Composition of Respirable Coal Mine Dust. Minerals 2021, 11, 276. https://doi.org/10.3390/ min11030276.
4. M Liu, C. Clement, K. Liu, X.Wang, T. D. Sparks. **2021**. A data science approach for advanced solid polymer electrolyte design, Computation Materials Science 187 (2021) 110108. DOI: 10.1016/j.commatsci.2020.110108.
5. Zhitao Yuan, Chen Zhang, Lixia Li, Xinyang Xu, Xuming Wang. **2020**, Density functional theory calculation of fracture surface of siderite and hematite. Powder Technology 376 (2020)373-379.
6. Y. Lu, W. Liu, X. Wang, H. Cheng, F. Cheng, J.D. Miller. **2020**. Lauryl Phosphate Flotation Chemistry in Barite Flotation. Minerals 10, 280; doi:10.3390/min10030280.
7. J. Jin, X. Wang, C.D. Wick, L. X. Dang, J.D. Miller. **2020**. Silica surface states and their wetting characteristics. Surface Innovations, Vo. 8 Issue 3.
8. Liu, W. Wang, Z. Wang X. Miller, J.D. **2020**. Smithsonite flotation with lauryl phosphate. Minerals Engineering 147 (2020) 106155.
9. Guangli Zhua & Yijun Cao, Yuhua Wang, Xuming Wang, Jan D. Miller, Dongfang Lu, Xiayu Zheng. **2020**. Surface chemistry features of spodumene with isomorphous substitution. Mineral Engineering. Vol. 146
10. Chao Wan & Hui Xu, Weiping Liu, Pengcheng Han, Xiyun Yang, Xuming Wang. **2020**. Novel Alkaline Method for the Preparation of Low-Chromium Magnesia. JOM. Vol. 72(1), 333-339.
11. Liu W, Xu H, Wang Z and Wang X. **2020**. Simulation of fatty acid adsorption at the magnesia surface. Surface Innovations 8(3): 172–181, https://doi.org/10.1680/jsuin.19.00054
12. W Liu, X Wang, JD Miller. **2019**. Collector Chemistry for Bastnaesite Flotation–Recent Developments. Mineral Processing and Extractive Metallurgy Review, 1-10.
13. W Liu, H Xu, Z Wang, X Wang. **2019**. Adsorption of water and fatty acids at magnesium hydroxide surface from an MDS perspective. Surface Innovations 7 (5), 304-316.
14. W. Liu, Hui Xu, Xichang Shi, Xiyun Yang, Xuming Wang. **2019**. Improved Lime Method to Prepare High-Purity Magnesium Hydroxide and Light Magnesia from Bischofite. JOM 2019**,** Vol. 71, Iss. 12 4674-4680.
15. Chun Bai, Zhijian Wu, Xiushen Ye, Haining Liu, Zhong Liu, Huifang Zhang, Quan Li, Jun L, and Xuming Wang, **2019.** Influence of the pH in Reactions of Boric Acid/Borax with Simple Hydroxyl Compounds: Investigation by Raman Spectroscopy and DFT Calculations, Organic & Supramolecular Chemistry, DOI: 10:1002/slct.201903740
16. Y Lu, X Wang, W Liu, E Li, F Cheng, JD Miller. **2019**. Dispersion behavior and attachment of high internal phase water-in-oil emulsion droplets during fine coal flotation. Fuel 253, 273-282.
17. G Zhu, Y Wang, X Wang, JD Miller, D Lu, X Zheng, Y Zhao, H Zheng. **2019.** Effects of grinding environment and lattice impurities on spodumene flotation, Transactions of Nonferrous Metals Society of China 29 (7), 1527-1537.
18. V Atluri, J Jin, K Shrimali, L Dang, X Wang, JD Miller. **2019.** The hydrophobic surface state of talc as influenced by aluminum substitution in the tetrahedral layer, Journal of colloid and interface science 536, 737-748.
19. Qinyu Zhu, Xuming Wang, and Jan D. Miller. **2019**. Advanced Nanoclay-Based Nanocomposite Solid Polymer

Electrolyte for Lithium Iron Phosphate Batteries. ACS Appl. Mater. Interfaces 2019, 11, 8954-8960. DOI: 10.1021/acsami.8b13735.

1. Vu N. T. Truong, Xuming Wang, Liem X. Dang, and Jan D. Miller. **2019**. Interfacial Water Features at Air−Water Interfaces as Influenced by Charged Surfactants. J. Phys. Chem. B 2019, 123, 2397-2404. DOI 10.1021/acs.jpcb.9b01246
2. C Gungoren, O Ozdemir, X Wang, SG Ozkan, JD Miller**. 2019.** Effect of ultrasound on bubble-particle interaction in quartz-amine flotation system, Ultrasonics sonochemistry 52, 446-454.
3. Venkata Atluri, Yuesheng Gao, Xuming Wang, Lei PanJan D. Miller. **2019**. The Influence of Polysaccharides on Film Stability and Bubble Attachment at the Talc Surface. Mining, Metallurgy & Exploration (2019) 36: 71. <https://doi.org/10.1007/s42461-018-0028-4>
4. Guangli Zhu, Xuming Wang, Enze Li, Yuhua Wanga, Jan D. Miller. **2019**. Wetting characteristics of spodumene surfaces as influenced by collector adsorption. *Minerals Engineering* 130 (2019) 117–128.
5. Behzad Vaziri Hassas, Jiaqi Jin, Liem Xuan Dang, Xuming Wang, and Jan D Miller, Attachment, Coalescence, and Spreading of Carbon Dioxide Nanobubbles at Pyrite Surfaces. *Langmuir*. **2018**, 34, 14317-14327. DOI: 10.1021/acs.langmuir.8b02929
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1. Weiping Liu, Luther W. McDonald IV, Xuming Wang, Jan D. Miller, **2018**, Bastnaesite flotation chemistry issues associated with alkyl phosphate collectors. *Minerals Engineering* 127 (2018) 286–295.
2. Ying Lu, Enze Li, Huaigang Cheng, Xuming Wang, Zhiping Du, Fangqin Cheng & Jan D. Miller, **2018**, Effect of Oxygen Functional Groups on the Surface Properties and Flotation Response of Fine Coal, Comparison of Rank with Oxidation, ***2018****,* *International Journal of Coal Preparation and Utilization****,***
3. Enze Li, Ying Lu, Fangqin Cheng, Xuming Wang, Jan D. Miller, **2018**, Effect of oxidation on the wetting of coal surfaces by water: experimental and molecular dynamics simulation studies*,* *Physicochem. Probl. Miner. Process*.,
4. Vu N.T. Truong, Liem X. Dang, Chen-luh Lin, Xuming Wang, Jan D. Miller, **2018**, Water film structure during rupture as revealed by MDS image analysis. *Physicochem. Probl. Miner. Process.,* 54(4), 2018, 1060-1069.
5. Kaustubh Shrimali, Venkata Atluri, Yan Wang, Sanket Bacchuwar, Xuming Wang, Jan D. Miller, **2018**, The nature of hematite depression with corn starch in the reverse flotation of iron ore, *Journal of Colloid and Interface Science**524 (****2018****) 337–349,*
6. Feng Jiang, Shaohua Yin, Libo Zhang, Jinhui Peng, Shaohua Ju, Jan D. Miller, Xuming Wang, **2018**, Solvent extraction of Cu(II) from sulfate solutions containing Zn(II) and Fe(III) using an interdigital micromixer, *Hydrometallurg****y***, Volume 177, May **2018**, Pages 116-122
7. Xuming Wang, Jan D. Miller, **2018**, Dodecyl amine adsorption at different interfaces during bubble attachment/detachment at a silica surface, *Physicochem. Probl. Miner. Process*., 54(1), **2018**, 81-88
8. Kaustubh Shrimali, Venkata Atluri, Xuming Wang, Jan D. Miller, **2018**, Adsorption of corn starch molecules at hydrophobic mineral surfaces, *Colloids and Surfaces A* 546 (**2018**) 194–202
9. Enze Li, Xuming Wang, Zhiping Du, Jan D. Millerc, Fangqin Cheng, **2017**, Specific anion effects on adsorption and packing of octadecylamine hydrochloride molecules at the air/water interface, *Colloids and Surfaces A*: *Physicochem. Eng. Aspects* 522 (**2017**) 544–551
10. Kaustubh Shrimali , Xihui Yin, , Xuming Wang , Jan D. Miller, **2017**, Fundamental issues on the influence of starch in amine adsorption by quartz, *Colloids and Surfaces A: Physicochemical and Engineering Aspects*Volume 522, 5 June 2017, Pages 642–651
11. Yue Lin, Yun Cheng, Jie Li, Jan D. Miller, Jin Liu and Xuming Wang, **2017**, Biocompatible and biodegradable solid polymer electrolytes for high voltage and high temperature lithium batteries, **RSC Adv.,** 2017, 7, 24856.
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13. Weiping Liu, Xuming Wang, Hui Xu, J.D. Miller, **2017**, Lauryl phosphate adsorption in the flotation of bastnaesite, (Ce,La)FCO3, *Journal of Colloid and Interface Science****,***Volume 490, 15 March 2017, Pages 825–833.
14. Y. Lin, X. Wang, J. Liu, J. D. Miller, **2017**, Natural halloysite nano-clay electrolyte for advanced all-solid-state lithium- sulfur batteries, *Nano Energy,* 31, pp. 478–485 (**2017)**
15. Jan D. Miller, Xuming Wang, Jiaqi Jin, Kaustubh Shrimali, **2016**, Interfacial water structure and the wetting of mineral surfaces, *International Journal of Mineral Processing*, *International Journal of Mineral Processing* 156 (2016) 62–68.
16. Zhijian Wu, Xuming Wang, Haining Liu, Huifang Zhang, Jan D. Miller, **2016**, Some physicochemical aspects of water-soluble mineral flotation, *Advances in* *Colloid and Interface Science*, 235 (2016) 190–200.
17. Biao Liu, Xuming Wang, Hao Du, Jing Liu, Shili Zheng, Yi Zhang, Jan D. Miller**, 2016**, The surface features of lead activation in amyl xanthate flotation of quartz, *International Journal of Mineral Processing*, Volume 151, 10 June 2016, Pages 33–39.
18. Kaustubh Shrimali, Jiaqi Jin, Behzad Vaziri Hassas, Xuming Wang, Jan D. Miller, **2016**, The surface state of hematite and its wetting characteristics, *Journal of Colloid and Interface Science*, 2016 Sep 1; 477:16-24.
19. Yue Lin, Jie Li, Kathy Liu, Yexiang Liu, Jin Liu and Xuming Wang, 2016, Unique starch polymer electrolyte for high capacity all-solid-state lithium sulfur battery, *Green Chemistry*, 2016,18, 3796-3803.
20. Weiping Liu, Xuming Wang, Zhixing Wang, J.D. Miller, 2016, Flotation chemistry features in bastnaesite flotation with potassium lauryl phosphate, *Minerals Engineering* 85 (2016) 17–22
21. Yunshan Guan, Jianfeng Li, Fangqin Cheng, Jing Zhao, Xuming Wang**, 2015**, Influence of salt concentration on DCMD performance for treatment of highly concentrated NaCl, KCl, MgCl2 and MgSO4 solution, *Desalination* 355 (2015) 110–117.
22. Li Cui 1, Yanxia Guo, Xuming Wang, Zhiping Du, Fangqin Cheng, 2015, Dissolution kinetics of aluminum and iron from coal mining waste by hydrochloric acid, *Chinese Journal of Chemical Engineering* 23 (2015) 590–596
23. Jing Liu, Xuming Wang, Chen-Luh Lin, Jan D. Miller, **2015**, Significance of particle aggregation in the reverse flotation of kaolinite from bauxite ore, *Minerals Engineering* 78 (2015) 58–65
24. Guan Yunshan, Wu Jing, Cheng Wenting, Li Jianfeng, Cheng Fangqin, Wang Xuming, **2015**, Recovery of KCl crystalline product from highly concentrated KCl-MgCl2-H2O solution with membrane distillation crystallization, *CIESC Journal* Vol. 66 No. 5, May 2015, 1767-1776
25. Xia Zhang, Hao Du, Xuming Wang, J.D. Miller, **2014**, Surface chemistry aspects of bastnaesite flotation with octyl hydroxamate, *International Journal of Mineral Processing* 133 (2014) 29–38
26. Xuming Wang, J.D. Miller, Fangqin Cheng, Huaigang Cheng**, 2014,** Potash flotation practice for carnallite resources in the Qinghai Province, PRC, *Mineral Engineering*, Vol. 66–68, Nov. 2014, pp 33–39.
27. Xia Zhang, Xuming Wang, and J.D. Miller, **2014**, Wetting of selected fluorite surfaces by water, ***Surface Innovations*,** Available online: 21 May 2014.
28. Xuming Wang; Xihui Yin; Jakub Nalaskowski; Hao Du; Jan. D. Miller, **2014**, Molecular features of water films created with bubbles at silica surfaces, *Surface Innovations* Volume 2 Issue SI3.
29. Jing Liu, Jan D. Miller, Xihui Yin, Vishal Gupta, Xuming Wang**, 2014**, Influence of ionic strength on the surface charge and interaction of layered silicate particles, *Journal of Colloid and Interface Science* (2014), doi: http:// dx.doi.org/10.1016/j.jcis.**2014**.06.028.
30. Du, H.; Ozdemir, O.; Wang, X.; Cheng, F.; Celik, M.S.; Miller, J.D., **2014**, Flotation chemistry of soluble salt minerals: from ion hydration to colloid adsorption, *Minerals & Metallurgical Processing*, 2014, Vol. 31, No. 1, pp. 1-20.
31. Ruifang Qiu, Fangqin Cheng, Xuming Wang, Jianfeng Li & Rui Gao , **2014**, Adsorption kinetics and isotherms of ammonia-nitrogen on steel slag, *Desalination and Water Treatment*, DOI: 10.1080/19443994.2014.912154.
32. Jing Liu, Linda Sandaklie-Nikolova, Xuming Wang, Jan D. Miller, **2014**, Surface force measurements at kaolinite edge surfaces using atomic force microscopy, *Journal of Colloid and Interface Science*, 2014 Apr 15; 420:35-40.
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34. Yanxia Guo, Yaoyao Li, Fangqin Cheng, Miao Wang, Xuming Wang, **2013**, Role of additives in improved thermal activation of coal fly ash for alumina extraction, *Fuel Processing Technology*, 110, 114–121, 2013.
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38. Xia Zhang, Hao Du, Xuming Wang and J.D. Miller, **2013,** Surface chemistry considerations in the flotation of rare-earth and other Semisoluble Salt Minerals, *Minerals & Metallurgical Processing*, February 2013. Vol. 30 No. 1. pp. 24-37.
39. Cui Li, Gao Rui, Cheng Fangqin, Li Jianfeng, Wang Xuming, **2013**, Remediation of contaminated surface water by permeable reactive barriers (PRBs): Lab-scale experiments with four industrial wastes as reactive media, *Applied Mechanics and Materials* Vols. 295-298 (2013**)** pp 1850-1854.
40. Xihui Yin, Vishal Gupta, Hao Du, Xuming Wang, Jan D.Miller, **2012**, Surface charge and wetting characteristics of layered silicate minerals”, *Advances in Colloid and Interface Science***,** 179-182 (2012), pp. 43-50.
41. Book Chapter, Molecular dynamics simulation analysis of solutions and surfaces in nonsulfide flotation system, H. Du, X. Yin, O. Ozdemir, J. Liu, X. Wang, S. Zheng, and J.D. Miller, in Molecular Modeling for the Design of Novel Performance Chemicals and Materials, Edited by Beena Rai, CRC Press Taylor & Francis Group, **2012**, Boca Raton London NewYork.
42. F. Cheng, Li. Cui, J.D. Miller and X. Wang, **2012**, Aluminum leaching from calcined coal waste using hydrochloric acid solution” *Mineral Processing and Extractive Metallurgy Rev*., Vols 33, Issue 6, **2012**, pp391-403.
43. Xiaojing Chen, Yanxia Guo, Fangqin Cheng, Huiping Song, Nan Zheng, Xuming Wang, **2012**, Application of modified coal fly ash as an absorbent for ammonia-nitrogen wastewater treatment, *Advanced Materials Research*Vols. 518-523 (**2012**) pp 2380-2384.
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52. Xuming Wang, Jin Liu, Hao Du, and J. D. Miller, **2010**, States of adsorbed dodecyl amine and water at a silica surface as revealed by vibrational spectroscopy, *Langmui****r***, 2010, 26 (5), pp 3407–3414.
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