***Dr. Courtney Young*** is a graduate of three premiere mineral/coal processing and extractive metallurgy institutions. His specialties in mineral processing and extractive metallurgy include mineral characterization and analysis, flotation, physical separations, leaching, cyanide, uranium, base and precious metal processing, and adsorption. He enjoys applying those technologies to secondary resource recovery, critical materials, mining sustainability including waste processing, water remediation, tailings and slags recycling, dust and spent pot-liner treatment, energy reduction, and flowsheet development.

Education

Ph.D. Metallurgical Engineering, University of Utah, College of Mines and Earth Sciences, Salt Lake City, UT, 84112, June 1994

M.S. Mining and Minerals Engineering, Virginia Polytechnic Institute and State University, Blacksburg, VA, 24061, September 1987

B.S. Mineral Processing Engineering, Montana College of Mineral Science and Technology, Butte, MT, 59701, May 1984

Registration

Registered Member (RM) SME – Society of Mining, Metallurgy and Exploration, 2021

Areas of Expertise

* **Process Engineering**
* **Mineral Separations**
* **Flotation**
* **Extractive Metallurgy**
* **Hydrometallurgy**
* **Mining Sustainability**
* **Remediation**
* **Waste Minimization**
* **Recycling**
* **Surface Chemistry**
* **Electrochemistry**
* **Characterization**
* **Analysis/Spectroscopy**
* **Critical Materials**

While a faculty member for 30 years, Courtney has taught numerous courses lately including Introduction to Mineral Processing, Hydrometallurgy and Aqueous Processing, Fire Assay, Materials Handling Design, Flotation, Energy Resources (mostly Coal, Uranium, Silicon and Rare Earth Elements), Precious Metal Resources (mostly Gold), Internship and Seminar. During this time, Dr. Young has worked on numerous research and consulting projects with various funding sources, particularly mining companies and often in collaboration with the Center for Advanced Materials Processing (CAMP).

**Professional Experience**

2001-Present Tenured Professor, M&ME, Montana Tech, Butte, MT

1998-2019 Department Head, M&ME, Montana Tech, Butte, MT

1996-2001 Associate Professor, M&ME, Montana Tech, Butte, MT

1995-1996 Assistant Professor, M&ME, Montana Tech, Butte, MT

1994 Research Assistant Professor and CAMP Postdoc, Montana Tech, Butte, MT

1993 Research Fellow and Postdoc, Mine Waste Technology Program (MWTP), Montana Tech, Butte, MT

**Professional Affiliations**

1999-Present American Exploration and Mining Association (AEMA), Trustee 2015-2018

1998-Present Montana Mining Association (MMA), Honorary Lifetime Member Since 2007

1982-Present Society for Mining, Metallurgy and Exploration (SME), Distinguished Member Since 2017

 **Professional Recognition**

**Patents**

8500847 (U.S.A.), AU2011201892 (Australia), and CA2738382 (Canada), Method for aqueous gold thiosulfate extraction using copper-cyanide pretreated carbon adsorption, with M. Melashvili and R.N. Gow, 2013.

U.S. Provisional Application No. 63/150,810, Chemical liberation of waste printed circuit boards, with B. Suslavich and A. Das, 2022.

***Awards***

Best MPD Presentation at Annual Meeting, SME, 2023.

Henry Krumb Lecturer, SME, 2021-2022.

Antoine M. Gaudin Award, SME, 2020.

Rose and Anna Busch **Faculty Achievement Award, Montana Tech, Butte, MT, 2019.**

Merit, Montana Tech, Butte, MT, 2018.

Lifetime **Distinguished Researcher Award, Montana Tech, Butte, MT, 2016.**

Mineral Industry Educator Award, AIME, 2016.

President’s Citation, SME, 2015.

***Honors***

SME Board of Directors, Nominated Feb 2022 and Confirmed Feb 2023 to serve Feb 2024-Feb 2027.

Planning Committee, International Mineral Processing Congress (IMPC), Washington DC, Sept 29-Oct 3, 2024, SME Lead on Innovation, Research and Development, February 2023-Present.

30-Year Recognition, Montana Tech, Butte, MT, 2023.

Honorary Organizer, International Congress of Mineral Flotation 2021, Lima, Peru, October 13-15, 2021.

Committee to Write the Argument for Rejection of I-186, State of Montana, July-August, 2018.

US Department of Energy, National Energy Technology Laboratory, Technical Program Reviewer, Rare Earth Element from Coal and Coal By-Products, Tasks 1-8, Pittsburgh, PA, March-April, 2018.

Best Presentations, top 20, at Molten ’16 **- 10th International Conference on Molten Slags, Fluxes and Salts, Seattle WA, and** *Copper Cobalt Africa – SAIMM 8th Base Metals Conference*, Livingstone Zambia.

***Plenary and Keynote Presentations***

Flotation 2022, Peru, “Mechanism of Orfom D8 Depression in Cu-Mo Separation,” November 9, 2022.

SAIMM Meeting, U of Pretoria, Plenary, “Spectroelectrochemistry of Enargite in Acidic and Alkaline Solutions,” and “Mineral Processing of Secondary Resources for Making Simulant,” June 25, 2015.

XXII International Congress in Extractive Metallurgy & Mineral Processing, Plenary, “Comparison of Au(CN)2- Adsorption on AC to Au(S2O3)23- Adsorption on Impregnated AC,” Mazatlan, MX, April 16, 2015.

***Guest Presentations***

**Henry Krumb Lectures. Gave 15 in-person and virtual presentations throughout the world.**

U of Nevada-Reno Mining and Metallurgical Engineering, “Industrial Outreach and Research for Mining Sustainability,” Seminar, March 3, 2017.

U of Nevada-Reno Min and Met Eng, “Helping the Mining Industry Through Research,” July 1, 2016.

Technological Institute of Saltillo, “Mineral Processing and Extractive Metallurgy Applications – Tailings Recycling and ARD Remediation,” Mazatlan, Mexico, April 20, 2015.

**Research Interests**

As an accomplished researcher, *Dr. Courtney Young* has been recognized with SME’s Antoine M. Gaudin Award in 2020 as well as Montana Tech’s Lifetime Distinguished Researcher Award in 2016. Most of his research involves mineral processing and extractive metallurgy and their application to secondary resource recovery, critical materials and mining sustainability issues. Consequently, his research has varied. Example research efforts include but are not limited to improving Au recovery, remediating cyanide, selecting and testing ores, recycling spent pot-liner, making synthetic lunar soil, repurposing slags and tails, treating acid-rock drainage, determining depressant action in Cu-Mo flotation, conducting Cu electrowinning for energy savings, modelling flotation, examining novel collectors in REE flotation, recovering valuables from slags and tails (PGMs, Cu, garnet, etc.), making pig Fe from slag, designing flowsheets, precipitating nano-Au, recycling plastics by surface modification and flotation, manufacturing TiO2 nano-particles for photocatalytic water remediation, and understanding surface reactions of sulfide minerals in flotation and leaching.

**Grants and Contracts**

 ***Federal Programs***

1. Army Research Lab (with Ronald White/CAMP as PI), Current (2022-23), Year 4 (2018-19). Year 3 (2017) Year 2 (2016), Year 1 (2015), and Year 0 (2014 through U of Alabama-Birmingham).
2. Office of Naval Research, “REE Processing by Leaching and Chelating SPCs,” $300,000 (2012-2016).
3. NASA, Matching Grant, “Lunar Soil Separates,” $1000 (2013); Travel Grant, “Lunar Soil Separates,” with Montana Space Grant Consortium at MSU-Bozeman, $1500 (2012); Ralph Steckler/Space Grant Space Colonization Research and Technology Program, “Multiple Terrestrial Resources for Simulating Lunar Soil,” with Montana Space Grant Consortium at MSU-Bozeman, $85,000 (2011).

***State/Institutional Programs***

1. Host to Dr. Kazutoshi Haga, Akita University, Japan, Overseas Transfer Program, $10,000 (September – October, 2022) and $15,000 (September – November, 2023).
2. Host to Dr. Sengpasith Houngaloune, Fullbright Scholar, National University of Laos, Vientiane Capital, Laos, $20,000 (September 2018 – December 2018).

***Industrial Programs***

1. Chevron-Phillips Chemical, “Confirmation of Orfom D8 Mechanism, Phase IV,” $154,000 (2023-2024), Phases I-III, $373,000 (2016-2020).
2. Disa, “Novel Ablation Process for Increased Recovery of Tailings,” $40,000 (2021).
3. Clariant, “Characterization of Frothers,” $30,000 (2020-2021).
4. UTRS, “Recycling of Slag by a Proprietary Process,” $22,110 (2018).
5. Barrick Golden Sunlight Mine and Sibanye-Stillwater Mining Company, “Recovering Au from Pyrite and PGM/Cu from Slag via Matte-Phase and Carbothermal Reactions,” $32,000 (2017-2018).
6. FX Solutions, with A. Das as Co-Pi, “Recovering Glass from Slag via Carbothermal Reduction,” $180,000 (2019-2020) and $210,000 (2017-2018).
7. AMinPro and Freeport McMoRan, “Crowding in Froth Flotation,” with R. LaDouceur, $16,000, 2017.
8. GMA Mining USA, “**Repurposing of garnet tailings,” $32,000, 2016.**
9. Newmont, “Undergraduate and Graduate Support,” $360,000, 2005-Present.

***Publications***

***Peer-Reviewed Journals (last 15)***

1. **“Review of the Mechanism for Orfom® D8 Depression of Chalcopyrite in Cu-Mo Separation during Cleaner Flotation,” A. Das, R. LaDouceur, S. Timbillah and S. Childress, *IJ Soc Mat Eng for Res*, 25(1):18-22, 2022.**
2. **“Effect of Frothers on Gas Dispersion in a Cavitation Sparger as Determined with Electrical Resistance Tomography,” R. LaDouceur and P. Holdsworth, *Minerals Engineering*, 160:106655, 2021.**
3. **“Theoretical and Experimental Investigation of the Interaction of a Novel Organic Depressant, Disodium Carboxymethyl Trithiocarbonate, in Cu-Mo Flotation,” S. Timbillah, R. LaDouceur and A. Das, *Minerals Engineering*, 169:106943, 2021.**
4. "Extraction and optimization of neodymium by molten fluoride electrolysis,” Separation & Purification Tech., P. Sarfo and A. Das, 256(7), 117770, 2021.
5. “Hydrometallurgical Recovery of Rare Earth Fluorides from Recycled Magnets and Process Optimization,” P, Sarfo, T. Frasz and A. Das, Minerals, 10(4):340-353, 2020.
6. “Characterization and Processing of Plant Tailings for the Recovery of Fine Garnet – A Case Study,”
7. **“Consideration and Construction of Potential-pO2- Diagrams with Emphasis on Molten Salt Electrolysis of Neodymium from Fluoride Baths,” P. Sarfo and H.H. Huang, Submitted, Met Mat Trans B, 2019.**
8. **“Consideration of the Pulp/Froth Interface in the Compartment Model of Flotation,” R. LaDouceur and P. Amelunxen,** *Minerals Engineering*, 2019.
9. **“Studies on the Nature of Salicylhydroxamate Adsorption at the Surface of Neodymium Oxide,” M. Sime, A. Das, G. Galt and G. Hope, *J. Disp. Sci & Tech*, 40(10): 1488-1498, 2019.**
10. **“Stability Diagrams for Copper-Sulfide and Copper-Recycle Systems Applied to Extractive Metallurgical Processes,” H.H. Huang and L.G. Twidwell, *IJ Soc Mat Eng for Res*, 23(2):128-136, 2018.**
11. **“A Phenomenological Model of Entrainment and Froth Recovery for Interpreting Laboratory Flotation Kinetic Tests, P. Amelunxen, R. Amelunxen, and R. LaDouceur,** *Minerals Engineering*, 125:60-65, 2018.
12. **“**Carbothermal Reduction of Copper Smelter Slag for Recycling into Pig Iron and Glass,**”** P. Sarfo, G. Wyss, G. Ma and A. Das, *Minerals Engineering*, 107:8-19, 2017.
13. **“**Recovery of Metal Values from Copper Slag and Reuse of Residual Secondary Slag,” P. Sarfo, A. Das and G. Wyss, *Waste Management*, 70:272-281, 2017.
14. “Xanthate Chemisorption at Copper and Chalcopyrite Surfaces,” J. Bowden, *JSAIMM, 116:503-8,* 2016.
15. “Utility of Mass-Balanced EH-pH Diagrams II – Applications of Gibbs Rule,” R.N. Gow and H. Huang, *Miner. Metall. Process, 33(3):107-115,* 2016.

***Peer-Reviewed Books and Proceedings (last 15)***

1. **“Synthesis and Characterization of the Hydroxamic Acid N,3-dihydroxy-2-napthamide and its Copper (II) Complex – An Investigation on Keto/Enol Forms and Rare Earth Flotation,” B. Suslavich, R. LaDouceur, A.W. Mamudu, Submitted, 2023.**
2. “Chapter 4: Flotation Principles and Kinetics - Application of Novel Depressants to Rare Earth Minerals,” Accepted in Y. Murty and M. Alvin (Editors), Rare Earth Industry Status and Prospects, R. LaDouceur and P. Amelunxen, Springer, in-print, 2023.
3. Orfom® D8: A Viable Replacement for NaHS as a Depressant in the Chalcopyrite-Molybdenite Flotation System,” S. Timbillah, R. LaDouceur and A. Das, In: Copper 2019, 10th Copper International Conference, Vancouver, BC, August 2019.
4. “Chapter 10.19: Aqueous Phase Redox Precipitation,” H.H. huang, In: R. Dunne, K. Kawatra and C. Young (Eds), *Mineral Processing & Extractive Metallurgy Handbook*, SME, Englewood, CO, 2019.
5. “Chapter 12.13: Graphene,” G. Wilson, In: R. Dunne, K. Kawatra and C. Young (Eds), *Mineral Processing & Extractive Metallurgy Handbook*, SME, Englewood, CO, 2019.
6. “Chapter 12.33: Silica, Quartz and Silicon,” D.C. Lynch, In: R. Dunne, K. Kawatra and C. Young (Eds), *Mineral Processing & Extractive Metallurgy Handbook*, SME, Englewood, CO, 2019.
7. “Chapter 1.1: Mineral Properties, Characterization & Processing,” A. Das, In: R. Dunne, K. Kawatra and C. Young (Eds), *Mineral Processing & Extractive Metallurgy Handbook*, SME, Englewood, CO, 2019.
8. “Fundamental Understanding of the Flotation Chemistry or Rare Earth Minerals,” S. Trant, G. Galt and A. Das, accepted, Proceedings of Extraction 2018, CIM, Ottawa, Ontario, Canada, August 26-29, 2018.
9. “A Fundamental Study of Di-Sodium Carboxymethyl Trithiocarbonate (Orfom® D8) in Flotation Separation of Copper-Molybdenum Sulfides,” S. Timbillah and A. Das, accepted, Proceedings of Extraction 2018, CIM, Ottawa, Ontario, Canada, August 26-29, 2018.
10. “Modeling and Optimization of Rare Earth Mineral Flotation Using Salicylhydroxamic Acid.” R. LaDouceur and P. Amelunxen, In: XXVIII International Mineral Processing Congress, CIM, Westmount, Quebec, Canada, 2016.
11. “Development of a Novel Technology to Reduce Energy Consumption During Electrowinning of Copper.” A. Das and F. Dakubo, In: XXVIII International Mineral Processing Congress, CIM, Westmount, Quebec, Canada, 2016.
12. “Characterization and Recovery of Valuables from Waste Copper Smelting Slag.” P. Sarfo, J. Young and G. Ma, Proceedings of **10th International Conf. on Molten Slags, Fluxes and Salts, pp. 889-898. 2016.**
13. “Xanthate Chemisorption at Copper and Chalcopyrite Surfaces,” J.L. Bowden, *Proceedings of Copper Cobalt Africa – 8th Base Metals Conference*, Livingstone Zambia, SAIMM, pp. 117-128, 2015.
14. “Spectroelectrochemistry of Enargite II: Reactivity in Acidic Solutions,” R.N. Gow, H. Huang and G. Hope*, Hydrometallurgy 2014* (E. Asselin et al, Editors), CIM, Quebec, Canada, pp. 397-408, 2014.
15. “Impregnated activated carbon for gold extraction from thiosulfate solutions,”R.N. Gow, M. Melashvili and M. LeVier, Hydroprocess 2013, Santiago, Chile’, July 10-12, 2013.

***Presentations*** (last 8 not associated with proceedings)

1. **“Effect of Mineral Type on the Flotation of REEs,” A. Das, Flotation 2022, Lima, Peru, Nov 9-11, 2022.**
2. **“Verification of 3-Zone Model for Flotation – An Application to Column Cells,” Rick LaDouceur and Phil Holdsworth, Flotation 2022, Lima, Peru, Nov 9-11, 2022.**
3. **“Loading the Bases with Students – Hitting Grand Slams with Industry,” 2020 Gaudin Award Lecture, Virtual presentation at SME Annual Meeting, Denver CO, 2021.**
4. **“Chalcopyrite Depression With Orfom® D8 During Cleaner Flotation Of Cu-Mo Bulk Concentrate: Theory And Practice,” SME Annual Meeting, Phoenix AZ, 2020 (Elected as SME Henry Krumb Lecture).**
5. **“Effect of Frothers on Gas Dispersion in a Cavitation Sparger as Determined with Electrical Resistance Tomography,” R. LaDouceur and P. Holdsworth, Flotation ’19, Cape Town, S. Africa, Nov 11-14 2019.**
6. **“The processing and recycling of garnet Tailings for recovery and mass reduction purposes,” A. Das, G. Wyss, M. Egloff and P. Rossiter, AEMA Annual Meeting, Reno NV, Dec 1-6, 2019.**
7. **“Repurposing Tailings for Added Value,” A. Das, G. Wyss, M. Egloff and P. Rossiter, Mining and Mineral Symposium, MBMG, Montana Tech, Butte MT, Oct 9-11, 2019.**
8. **“Consideration and Construction of Potential-PO2- Diagram with Emphasis on Molten Salt Electrolysis of Neodymium from its Oxide,” P. Sarfo and H.H. Huang, 233rd Annual Meeting of Electrochemical Society, Seattle WA, May 13-17, 2018.**

**Student Advisees**

***Ph.D. Dissertation*** – 1 Current and 6 Graduates

***M.S. Thesis*** – 7 Current and 30 Graduates

***M.S. Non-Thesis*** – 8 Graduates

***B.S. Undergraduate Research*** – 3 Current and 124 Graduates

**Service – Academic, Professional and Community**

***Advisee Letters*** – 43 Awardees

## Department and Campus – Department Head, Student and Club Advisor, Faculty Senate, Advising/Retention Steering, Traffic, Strategic Planning, Enrollment Services, Undergraduate Research, Library, Curriculum Review, Budget, Scholarship, and various Search Committees

***Chairs and Vice-Chairs – Last 8 include*** SME Council of Education, SME Ivan Rahn Education Award, SME Education Sustainability, SME PhD Grant and Career Grant Selection, SME Accreditation and Curricular Issues, Mineral Industry Education Award, SME MPD Nominating, and AIME James Douglas Gold Medal

***Committees Last 8 include*** SME Board of Directors, AIME Fritz Medal, SME MPD Technical Content Advisor, AEMA Board of Trustees, SME PhD Grant and Career Grant Selection, Ivan B. Rahn Education Award, SME Government, and SME Distinguished Member

### *Conferences, Symposia and Programs – Last 5 include* IMPC 2024, Flotation 2022, Hydroprocess 2013, Roe-Hoan Yoon Symposium, and Workshop for the Lunar Applications of Mining and Mineral Beneficiation

***Session Chairs – Over 40 with the last being*** *Flotation 2022*

***Peer-Reviews – Over 15 with the last being*** *Mineral Processing & Extractive Metallurgy Handbook*

***Short Courses – Principles of Mineral and Metallurgical Processing*** *and* ***Fundamentals of Fire Assay***

***Community – Over 15 Activities including current*** *Butte Natural Resource Council (BNRC)*