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### **Education**

B.S. Earth Sciences, National Cheng Kung University, 1974  
M.S. Geosciences-Mineralogy and Geology Program, Purdue University, 1980  
PhD. Purdue University, 1982. Multi disciplinary, Areas and Advisors Include: Electrical Engineering: Fritz J. Friedlaender; Geology: Gunnar Kullerud; Metallurgical Engineering: Reinhardt Schuhmann, Jr.; Chemical Engineering: Phillip C. Wankat.

### **Professional Experience**

Michigan Technological University  
Institute of Materials Processing: Director, 1992-present; Program Manager, 1988-1992; Research Scientist, 1984-1987.

Department of Materials Sciences and Engineering: Associate Professor, 2004-present

Department of Geological & Mining Engineering & Sciences: Associate Professor, 2002-2004

Department of Mining Engineering: Department Chair, 1999-2000, Associate Professor, 1997-2002

Department of Chemical Engineering: Adjunct Faculty, 2002-present

Department of Civil and Environmental Engineering: Graduate Faculty, 1993-present

Department of Electrical Engineering: Adjunct Faculty, 1985-present

Department of Geology and Geological Engineering: Adjunct Faculty, 1985-present

Purdue University  
School of Electrical Engineering and Indiana Mining and Mineral Resources Research Institute (50/50): Postdoctoral Research Associate, 1982-1984

### **Professional Societies**

AIME/TMS The Minerals, Metals, and Materials Society  
AIME/SME Society for Mining, Metallurgy, and Exploration  
IEEE Society of Magnetics  
IEEE Industry Applications Society  
American Foundrymen's Society

### **Public Services**

Editor-in-Chief, Journal of Mineral and Materials Characterization and Engineering, 2001-present  
Editor, International Journal of Mineral Processing, 1990-2000  
1988, Co-chairman, SME Application to Mineral Beneficiation Session  
1989, Chairman, SME Application to Mineral Beneficiation Session  
1990, Chairman, TMS Characterization and Materials Recycling Session  
1990, ASM Thermal Spray Industry Group, Environmental Committee  
1991, Chair-Elect, SME and TMS Process Mineralogy Committee

1992, Committee Chair, SME and TMS, Process Mineralogy  
1993, Chairman, SME Chemical Assaying Application Session  
1993, Chairman, HazMat-North Am., Industrial Hazardous Wastes Problems and Solutions  
1995, Chairman, TMS, Pyrometallurgy, Beneficiation, and Solution Mining Section  
2001, Chair-Elect, SME Process Mineralogy Committee  
2002, Chair, SME Process Mineralogy Committee  
2004, Chair, TMS Materials Characterization Committee, Symposium Organizer  
2005, Chair, TMS Materials Characterization Committee, Symposium Organizer

#### **Awards/Honors**

Chinese Culture and Science Scholarship (Top Student) 1972-1974.  
Championship Graduate Team Advisor, Automotive Solutions Competition, sponsored by APC, VRP and SAE, 1994  
Service Recognition Award, TMS 1993  
Honorary Guest Professor, Beijing University of Science and Technology, 2000  
Honorary Guest Professor, China University of Geosciences, 2002  
Fulbright Research Fellow Advisor, 2005  
Keynote Speaker, Sohn International Symposium, 2006 (invited and accepted).

#### **Technical Topics of Expertise**

Microwave Processing of Materials, Hydrogen Storage Materials, Steelmaking, Development of Magnetic, Electrostatic, Flotation, and other Physical Separation Methods. Characterization of Minerals, Materials and Wastes, Mineralogy and Liberation. Surface Chemistry; Dispersion, Agglomeration and Surface Modifications of Fine Particles. Beneficiation of Coal, Minerals, and Solid Wastes. Ferrofluid and Magnetizing Reagents, Foundry Sand Reclamation, Plastic Recycling, Plating Sludge Leaching and Pyro Processing. Flyash Processing and Utilizations for Concrete, Filler, Ceramic, and Activated Carbon Applications. Automobile Shredding Residues (Fluff) Processing. Mixed Plastics Separation. Medical Wastes Sterilization. Activated Carbon Preparation. Lubricant Cleaning. Paper Deinking. Kraft Paper Wastewater Decoloring. Fine Particle Emission Control. Toxic Emission Control. Paint separation from Abrasives. Glass Recycling and Reuse. Mercury Adsorption.

#### **Publications**

- 1978 H.O.A. Meyer, J.Y. Hwang, and R.H. McCallister, "Luna 24: Mineral Chemistry of 90-150 Micron Clasts," Proc. Lunar and Planetary Sci. Conf., 9th, pp. 2137-2147.
- 1982 J.Y. Hwang, G. Kullerud, M. Takayasu, F.J. Friedlaender, and P.C. Wankat, "Selective Seeding for Magnetic Separations," IEEE Transactions on Magnetics, Vol. MAG-18, pp. 1689-1691.
- 1982 J.Y. Hwang and H.O.A. Meyer, "The Mineral Chemistry and Genesis of the Chinkuashik Ore Deposit, Taiwan," Proc. Geol. Soc. of China, p. 88-101.
- 1983 J.Y. Hwang and H.O.A. Meyer, "Dacite-Andesite of the Chinkuashih Region, Northern Taiwan," Memoir Geol. Soc. of China, No. 5, pp. 67-84.
- 1984 M. Takayasu, J.Y. Hwang, F.J. Friedlaender, L. Petrakis, and R. Gerber, "Magnetic Separation Utilizing a Magnetic Susceptibility Gradient," IEEE Transactions on Magnetics, Vol. MAG-20, pp. 155-159.
- 1984 J.Y. Hwang, M. Takayasu, F.J. Friedlaender, and G. Kullerud, "Application of Magnetic Susceptibility Gradients to Magnetic Separation," Journal of Applied Physics, Vol. 55, pp. 2592-2594.
- 1984 P.C. Wankat, J.Y. Hwang, D. Beckemeyer, F.J. Friedlaender, "Removal of Paramagnetic Particles from Single Wire HGMS," IEEE Transactions on Magnetics, Vol. MAG-20, pp. 1177-1179.

- 1984 W. Leitermann, F.J. Friedlaender, R. Gerber, J.Y. Hwang and B.B. Emory, "Collection of Micron Sized Particles at High Velocities in HGMS," IEEE Transactions on Magnetics, Vol. MAG-20, pp. 1174-1176.
- 1985 J.Y. Hwang, G. Kullerud, F.J. Friedlaender, and M. Takayasu, "A Method for Alunite Beneficiation," AIME Prepublications, No. 85-11.
- 1986 J.Y. Hwang, D.H. Carlson, A.M. Johnson and J. VanAlstine, "Preliminary Investigation of Graphite Resources in Michigan," Process Mineralogy VI, ed. by R.D. Hangi, The Metallurgical Society, pp. 315-327.
- 1986 J.Y. Hwang and G. Kullerud, "Recovery of Nb/Y/REE/Th from a Norwegian Ore by High Gradient Magnetic Separation," abstract, 115th AIME Annual Meeting, New Orleans.
- 1987 G. Kullerud and J.Y. Hwang, "New Methods of Mineral Separation," Proceedings of the International Symposium on Modern Mineralogy, Seoul, South Korea, pp. 1-12.
- 1987 J.Y. Hwang, G. Kullerud, F.J. Friedlaender, M. Takayasu, "Ultrafine Particle Processing: Alunite Beneficiation," AIME-SME Transactions, Vol. 280, pp. 1961-1964.
- 1988 J.Y. Hwang, D.C. Yang and C. Li, "Coal Characterization and Its Relation to Physical Cleaning," 117th AIME Annual Meeting, Phoenix, Arizona, Process Mineralogy VIII, ed. by D.J.T. Carson and A.H. Vassiliou, pp. 235-247.
- 1989 J.Y. Hwang, R.S. Kramer, and J. Liu, "The Role of Processing Mineralogy in Optimizing a Flowsheet for Recovery of Copper from White Pine Ore," 118th AIME Annual Meeting, Las Vegas.
- 1989 J. Liu, L. Cui, and J.Y. Hwang, "Flotation of Rutile with Benzyl Arsonic Acid," 1989 International Symposium on Applied Mineralogy, Montreal, Canada, Process Mineralogy IX, ed. by W. Petruk, R.D. Hagni, S. Pignolet-Brandom, and D.M. Hausen, pp. 143-153.
- 1989 R.S. Kramer, J.Y. Hwang, and A.M. Johnson, "A Mineralogical and Chemical Evaluation of the Graphite Resource in the Lower Slate Member, Michigamme Formation, Michigan," 1989 Symposium on the Geology of Michigan and Its Geological Resources, East Lansing, Michigan.
- 1990 J.W. Keck, D.H. Carlson, C.W. Schultz, and J.Y. Hwang, "Leaching Composites of Five Plating Wastes with Ammonium Carbonate," 119th AIME TMS Annual Meeting, EPD Congress '90, D.R. Gaskell ed., pp. 529-537.
- 1990 J.Y. Hwang, "Fine Coal Cleaning with Advanced Magnetic Enhancement Technology," Sixth Coal Preparation Utilization, and Environmental Control Conference, Pittsburgh, August, Proceedings, pp. 290-297.
- 1991 P.R. Mainwaring, R.S. Kramer, J. Y. Hwang, and L.M. Sutter, "Improved Characterization of Materials by Integrated Image Analysis and Microanalysis Methods," 120th Annual TMS Meeting, New Orleans, Louisiana; Journal of Metals, November 1990, p. 62.
- 1991 J.Y. Hwang, A. M. Hein, R.S. Kramer, J. Liu, T.J. Hozeska, Q. Zhang, and T.E. Scott, "Application of Characterization on Fly Ash Beneficiation to Produce Quality Controlled Products," 120th Annual TMS Meeting, New Orleans, Louisiana; Process Mineralogy XI: Characterization of Metallurgical and Recyclable Products, D. M. Hausen et al ed., pp. 167-180.
- 1991 J.Y. Hwang, "Methods to Make Fine Particles Magnetic," The 22nd Fine Particles Society Annual Meeting, San Jose, California, July 1991, Preprint, 9 p.

- 1992 J.Y. Hwang, X. Liu, R.S. Kramer, J. Liu, A.M. Hein, and Y. Wu, "Physical Concentration Processes for Reclaiming Foundry Sands," SME Annual Meeting Preprint No. 92-228, February 24-27, Phoenix, Arizona, 17 p.
- 1992 J.Y. Hwang, J. Liu, and M.L. Gray, "Coal Cleaning by Magnetic Reagent," SME Annual Meeting, February, Phoenix, Arizona, SME Preprint 92-227, 9 p.
- 1992 J.Y. Hwang, "Magnetic Reagent Technology for Mineral Processing," SME Annual Meeting, February, Phoenix, Arizona, SME Preprint 92-226, 9 p.
- 1992 R.I. Kramer, J.Y. Hwang, P.J. Suardini, A.M. Hein, "A Characterization Study of Pyrite in Three Coals Utilizing SEM, EDS, & Image Analysis," SME Annual Meeting, February, Phoenix, Arizona.
- 1992 P. T. Suardini, J. Y. Hwang, T. Durney, and D. Mills, "Studies of Alternative Medias and Procedures for Fine-Coal Washability Analyses Using a Batch, Rotor-and-Bucket Centrifuge," Coal Testing Conference, Lexington, Kentucky, March 1992, preprint, 19 p.
- 1992 Zhang, S., X. Wang, and J. Y. Hwang, "Microstructure of Activated Carbon from Wastepaper," Proceedings of the 29th Annual Electron Microscopy Colloquium, Iowa State University, Ames, Iowa, May 8-9.
- 1993 X. Liu, J.Y. Hwang, T.J. Hozeska, A.M. Hein and R.S. Kramer, "Generation of Magnetic Sand during Thermal Treatment of Silica Sand," AFS Annual Meeting 1993, Paper Number 93-112.
- 1993 R.S. Kramer, J.Y. Hwang, and A.M. Hein, "Identification of Low Concentration Phosphate Species in Iron Ore Using SEM/EDS/Image Analysis," SME-AIME Annual Meeting, Reno, NV, February 15-19, 1993, Paper number 93-057.
- 1993 X. Liu, R.S. Kramer, A.M. Hein, J.Y. Hwang, and G. Wang, "Mineralogical Evaluation of the Effect of Reclamation Processing Variables on Chromite Foundry Sand," SME Annual Meeting Preprint No. 93-210, Reno, NV, February 15-19, 1993, Paper number 93-210.
- 1993 X. Liu, J.Y. Hwang, T.J. Hozeska, and A.M. Hein, "Concrete Application for Magnetic Sand Waste from Steel Foundries," Proceedings of Waste Stream Minimization and Utilization Innovative Concepts - An Experimental Technology Exchange, Volume 1 - Industrial Solid Waste Processing, Municipal Waste Reduction/Recycling, Austin, Texas, April 22-23, 1993, R. L. Watts, Project Manager and V.E. Lee, Editor, USDOE/BATTELLE, PNL-SA-22193, Vol.1, pp.1.1-1.12.
- 1993 X. Liu, J. Y. Hwang, T. J. Hozeska, A. M. Hein, and R. S. Kramer, "Generation of Magnetic Sand during Thermal Treatment of Silica Sand," AFS Transactions, Vol. 101, pp. 327-333.
- 1993 J. Y. Hwang, X. Liu, B. Kesling, "Sand Reclamation for a Steel Foundry," AFS 1993 Annual Meeting, Paper Number 93-57.
- 1993 R. S. Kramer and J. Y. Hwang, "Magnetic Reagent Technology for Mineral Processing," Invited Paper, presented (by R. Kramer) at Upper Peninsula Section AIME/SME Annual Meeting, April 22, 1993.
- 1993 X. Liu, J. Y. Hwang, R. S. Kramer, A. M. Hein, and T. J. Hozeska, "Thermal Reclamation of oil Urethane Nobake Sands for A Steel Foundry," AFS Transactions, Vol. 101, 1993.
- 1993 R. S. Kramer, J. Y. Hwang, X. Huang, and T. Hozeska, "Characterization of Recyclable Components in Fly Ash to Produce Marketable Products," 1993 TMS Annual Meeting, Extraction and Processing for the Treatment and Minization of Wastes, Edited by J. Hager, B. Hansen, W. Imne, J. Pusatori and V. Ramachandran, TMS, pp. 1075-1096.

- 1994 J. Hwang, X. Huang, and A. M. Hein, "Synthesizing Mullite from Beneficiated Fly Ash," JOM, May 1994, pp. 36-39.
- 1994 J. Y. Hwang, X. Liu, B. Kesling, "Sand Reclamation for a Steel Foundry," AFS Transactions, Vol. 101, pp.807-815.
- 1994 R. Kramer, X. Liu, J. Y. Hwang, and G. Wang, "Mineralogical Evaluation of the Effect of Reclamation Processing Variables on the Chemistry of Foundry Sand," Process Mineralogy XII, TMS 1994, pp. 379-393.
- 1994 R. Kramer and J.Y. Hwang, "Identification of Low Concentration Phosphate Species in Iron Ore Using SEM/EDS/Image Analysis", Process Mineralogy XII, TMS, pp.309-316.
- 1994 X. Liu, J. Y. Hwang, T. J. Hozeska and B. Kesling, "Microwave Heating Characteristics of Selected Sands and Binders Used in Foundry Operation," AFS Annual Meeting, Paper Number 94-097.
- 1994 J. Y. Hwang, X. Liu, T. J. Hozeska and B. Kesling, "A Study of Reclamation of Foundry Sand Using Microwave Selective Heating," AFS 1994 Annual Meeting, Paper Number 94-098.
- 1995 X. Liu, J. Y. Hwang, A. M. Hein and R. Kramer, "Separation of Chromite and Silica from Reclaimed Foundry Sand Using Physical Concentration Processes," Process Mineralogy XIII, TMS 1995, pp. 41-59.
- 1995 J. Y. Hwang, X. Huang, R. Tieder, and A. M. Hein, "Refractory Material Produced from Beneficiated Fly Ash," Proceedings: 11th International Symposium on Use & Management of Coal Combustion By-Products (CCBs), Vol. I, Orlando, Florida, Jan. 15-19, 1995, pp. 32-1 to 32-13.
- 1995 J. Y. Hwang, X. Liu, F.V. Zimmer, T.R. Thiruvengadam, T. Patzias, Beneficiation Process for Fly Ash and the Utilization of Cleaned Fly Ash for Concrete Application," Proceedings: 11th International Symposium on Use & Management of Coal Combustion By-Products (CCBs), Vol. I, Orlando, Florida, Jan. 15-19, 1995, pp. 11-1 to 11-16.
- 1995 X. Huang, J. Y. Hwang, and R. Tieder, "Clean Ash as Fillers in Plastics," Proceedings: 11th International Symposium on Use & Management of Coal Combustion By-Products (CCBs), Vol. I, Orlando, Florida, Jan. 15-19, 1995, pp. 33-1 to 33-15.
- 1995 X. Liu, J.Y. Hwang, T.J. Hozeska and B. Kesling, "Microwave Heating Characteristics of Selected Sands and Binders Used in Foundry Operation", AFS Transactions, Vol. 102, pp.427-432.
- 1995 X. Liu, J. Y. Hwang, M.O. Curtis, and A.C. Clishe, "Effect of Fly Ash Beneficiation Process on Quality of Processed Bottom Ash, ESP Fly Ash, Dust Collector Fly Ash, their Mixtures, and Performance of Concrete Containing these Processed Ash Samples," Proceedings: 11th International Symposium on Use & Management of Coal Combustion By-Products (CCBs), Vol. I, Orlando, Florida, Jan. 15-19, 1995, pp. 12-1 to 12-16.
- 1995 J. Y. Hwang, X. Liu, T. J. Hozeska and B. Kesling, "Reclamation of Foundry Sand Using Microwave Selective Heating," AFS Transactions, Vol. 102, pp.789-795.
- 1995 X. Huang, J.Y. Hwang, and B.C. Mutsuddy, "Properties of Mullite Synthesized from Fly Ash and Alumina Mixture," Interceram, Vol. 44, No. 2, 1995, pp. 65-71.

- 1996 G.D. Mendenhall, Y. Geng, and J.Y. Hwang, "Optimization of Long-Term Stability of Magnetic Fluids from Magnetite and Synthetic Polyelectrolytes," *Journal of Colloid and Interface Science*, 184, 1996, pp. 519-526.
- 1996 Z. Li, X. Wang, Q. Zhang, and J.Y. Hwang, "Recovery of Titanium from Blast-Furnace Slag - A Pyro-modification and Beneficiation Approach," Second International Symposium on Extraction and Processing for the Treatment and Minimization of Wastes, TMS, 1996, pp. 417-426.
- 1997 X.M. Song, J.Y. Hwang, and X. Liu, "Utilization of Beneficiated Low NO<sub>x</sub> Fly Ash in Concrete and Concrete Block," *Proceedings: 12<sup>th</sup> International Symposium on Coal Combustion By-Product (CCB) Management and Use*, Vol. 1, EPRI TR-107055-V1, January 1997, pp. 30-1 to 30-16.
- 1997 X. Huang, J.Y. Hwang and J.M. Gillis, "Processed Low NO<sub>x</sub> Fly Ash as a Filler in Plastics," *Proceedings: 12<sup>th</sup> International Symposium on Coal Combustion By-Product (CCB) Management and Use*, Vol. 1, EPRI TR-107055-V1, January 1997, pp. 22-1 to 22-24.
- 1997 X. Huang, J.Y. Hwang and X. Song, "High Performance Auto Parts Could be Produced Using CastCon Manufacturing Process," *Proceedings of 1997 SAE International Congress & Exposition*, Feb. 24-27, 1997, Cobo Center, Detroit, Paper No. 970429.
- 1997 X. Huang, J.Y. Hwang and X. Song, "CastCon-A Combination of Casting, Forging, P/M, Bonding and Coating to Produce High Performance Components," *Proceedings of 5<sup>th</sup> International Conference on Advanced Particulate Materials and Processes*, April 7-9, 1997, West Palm Beach, Florida.
- 1997 J.Y. Hwang, "Unburned Carbon from Fly Ash, A Hidden Treasure," 3<sup>rd</sup> Annual Conference on Unburned Carbon on Utility Fly Ash, U.S. Department of Energy, May 1997, Pittsburgh, Pennsylvania, FETC Publication, 1997 Conference Proceedings, pp.1-3 .
- 1997 J.Y. Hwang and X.M. Song, "Replacing Al Powder with Al Slag or Recycled Foil in Cellular Concrete," *JOM* V. 49, No. 8, pp. 29-30.
- 1997 J.Y. Hwang, "Powder Technology in Concrete," *Powder Metallurgy*, V. 40, No. 3, p. 160.
- 1997 J.Y. Hwang, "Aluminum Wastes Cut Cost of Cellular Concrete," *Advanced Materials & Processes*, 5/97, p. 9.
- 1997 X.M. Song and J.Y. Hwang, "A Study of the Microscopic Characteristics of Fracture Surface of MDI-Bonded Wood Fiber/Recycled Tire Rubber Composites Using Scanning Electron Microscopy," *Wood and Fiber Science*, 29(2), pp. 131-141.
- 1997 X. Huang, J.Y. Hwang and X. Song, "High Performance Auto Parts Could be Produced Using CastCon Manufacturing Process," *Journal of Materials & Manufacturing*, Vol. 106, Sec. 5, pp.446-451.
- 1998 Z. Li and J.Y. Hwang, "A Study of the Microscopic Characteristics of Fracture Surface of MDI-Bonded Wood Fiber/Recycled Tire Rubber Composites Using Scanning Electron Microscopy," *Wood and Fiber Science*, 29(2), pp. 131-141.
- 1998 J.Y. Hwang, "Utilization of Low NO<sub>x</sub> Coal Combustion By-Products," *Proceedings of the Advanced Coal-Based Power and Environmental Systems*.
- 1999 J.Y. Hwang, X. Huang, J. Gillis, A. Hein, D. Popko, R. Tieder, and M. McKimpson, "Separation and Utilization Technologies of Low NO<sub>x</sub> Ash," *Proceedings: 13<sup>th</sup> International Symposium on Use and Management of Coal Combustion By-Products*, Vol. 1, pp. 19-1 to 19-22.

- 1999 J.Y. Hwang and M. Lee Jeong, "Utilization of Microalgae to Mitigation CO<sub>2</sub>," RITE NOW (33<sup>rd</sup> Issue), p 16.
- 1999 J.Y. Hwang, "Beneficial Use of Fly Ash," Proceedings: 13<sup>th</sup> U.S./Korea Joint Workshop on Energy and Environment, pp 373-396.
- 2000 J.Y. Hwang, R.C. Greenlund, M. Jeong, A.M. Hein, D.C. Popko, R. Peterson, and R. McChesney, "Eddy Current Separation of Aluminum Smelting By-Products," Fourth International Symposium on Recycling of Metals and Engineered Materials, edited by D.L. Steward, Jr., J.C. Paley, and R.L. Stephens, pp. 1181.
- 2000 J.Y. Hwang and X. Huang, "Processing High LOI Fly Ash for Plastic Applications," Proceedings: 17<sup>th</sup> Annual International Pittsburgh Coal Conference, paper 29-2
- 2001 Z. Xu, B.C. Cornilsen, D.C. Popko, W.D. Pennington, J.R. Wood, and J.Y. Hwang, "Quantitative Mineral Analysis by FTIR Spectroscopy," J. Vibrational Spectroscopy, Vol. 5, No. 4, pp. 1-11.
- 2001 J.Y. Hwang and M. Jeong, "Separation and Quantification of Hazardous Wastes from Abrasive Blast Media," Journal of AOAC International, Vol. 84, No. 3, pp.1-7.
- 2001 X.M. Song and J.Y. Hwang, "Mechanical Properties of Wood Fiber/Recycled Tire Rubber Composites," Forest Products Journal, Vol. 51, No. 5, pp. 45-51.
- 2001 J.Y. Hwang, R.C. Greenlund, X. Huang, and M.L. Jeong, "Characterization of Eddy Current Separation Samples of Aluminum Smelting By-Products," SME Annual Meeting, Feb 26-28, Denver, Colorado, Preprint 01-89, pp.1-14.
- 2002 J.Y. Hwang, X. Sun, Z. Li, "Unburned Carbon from Fly Ash for Mercury Adsorption: I. Separation and Characterization of Unburned Carbon," Journal of Minerals and Materials Characterization and Engineering, V.1, No. 1, pp. 39-60.
- 2002 B. Li, S. Yu, J. Y. Hwang, and S. Shi, "Antibacterial Vermiculite Nano-Material," Journal of Minerals and Materials Characterization and Engineering, V.1, No. 1, pp. 61-68.
- 2002 J.Y. Hwang, X. Sun, Z. Li, "Unburned Carbon from Fly Ash for Mercury Adsorption: II. Adsorption Isotherms and Mechanisms," Journal of Minerals and Materials Characterization and Engineering, V.1, No. 2, pp. 79-96.
- 2002 J.Y. Hwang, S. Shi, Z. Xu, and X. Huang, "Oxygenated Leaching of Copper Sulfide Mineral Under Microwave Hydrothermal Conditions," Journal of Minerals and Materials Characterization and Engineering, V.1, No. 2, pp. 111-119.
- 2002 J. Y. Hwang, "Adsorption of Surfactant Dispersed Nanometer Magnetite," Journal of Minerals and Materials Characterization and Engineering, V. 1, No. 2, pp. 132-140.
- 2002 X. Huang, J.Y. Hwang, S. Shi, R.C. Greenlund, Z. Xu, A.M. Hein, "Potential Application of Microwaves in Steelmaking," 3<sup>rd</sup> World Congress on Microwave and Radio Frequency Applications, Sydney, Australia, September 2002
- 2003 X. Wang, J.Y. Hwang, R.C. Greenlund, A.M. Hein, X. Huang, "Effects of Flow Speed, Flow Pattern and Air Bubble on Pressure Loss in Slurry Handling", Minerals & Metallurgical Processing Journal and Transactions, Vol. 20, No. 1, Page 36-41.
- 2003 X. Huang, J.Y. Hwang, and J.M. Gillis, "Processed Low NO<sub>x</sub> Fly Ash as a Filler in Plastics", Journal of Minerals and Materials Characterization and Engineering, V.2, No. 1, pp. 11-31.

- 2003 Z. Xu, J.Y. Hwang, R. Greenlund, X. Huang, J. Luo, and S. Anschuetz, "Quantitive Determination of Metallic Iron Content in Steel-Making Slag", *Journal of Minerals and Materials Characterization and Engineering*, V. 2, No. 1, pp. 65-70.
- 2003 J.Y. Hwang, S. Shi, Z. Xu and X. Huang, "Microwave Assisted Chalcocite Leaching in CuCl<sub>2</sub>- NaCl Media Under Oxygen Pressure", *EPD Congress 2003*, Edited by M.E. Schlessinger, TMS, pp. 11-16.
- 2003 B. Li, J.Y. Hwang, X. Huang, Z. Xu and S. Yu, "Characterization of Copper Vermiculite Antibacterial Nanomaterial", *EPD Congress 2003*, Edited by M.E. Schlessinger, TMS, pp. 29-36.
- 2003 S. Shi and J.Y. Hwang, "Microwave-Assisted Wet Chemical Synthesis: Advantages, Significance, and Steps to Industrialization", *Journal of Minerals and Materials Characterization and Engineering*, V.2, No. 2, pp. 101-110.
- 2003 S. Shi and J.Y. Hwang, "Plasma Spray Fabrication of Near-Net-Shape Ceramic Objects", *Journal of Minerals and Materials Characterization and Engineering*, V. 2, No. 2, pp. 145-150.
- 2003 M.L. Jeong, J.M. Gillis, J.Y. Hwang, "Carbon Dioxide Mitigation by Microalgal Photosynthesis", *Bull. Korean Chem. Soc.*, V. 24, No. 12, pp. 1763-1766.
- 2004 J. Luo, A.M. Hein, and J.Y. Hwang, "Adsorption of Vapor Phase Mercury on Various Carbons", *Journal of Minerals and Materials Characterization and Engineering*, V. 3, No. 1, pp. 13-22.
- 2004 J. Luo, J.Y. Hwang, R.C. Greenlund, X.Sun, and Z. Xu, "Adsorption of Hg on Unburned Carbon with HF Leaching", *Journal of Minerals and Materials Characterization and Engineering*, V. 3, No. 1, pp. 41-51.
- 2004 J.Y. Hwang and X. Huang, "Microwave Production of Steels", *Proceedings of 2004 Conference of Structural Engineers Association of Texas*, Invited Speaker, Lakeway, Texas, pp. 1-10..
- 2004 J.Y. Hwang, S. Shi, Z. Xu and K.W. Peterson, "Synthesis of Monodispersed Iron Oxide Particles in a Large-Scale Microwave Reactor", *AICHe Annual Meeting, Proceedings Fourth World Congress on Microwave and Radio Frequency Applications*, p. 124.
- 2004 S. Shi, J.Y. Hwang, B. Li and X. Huang, "An Investigation into the Sintering of Magnesium Fluoride", *Journal of Minerals and Materials Characterization and Engineering*, V. 3, No. 2, pp. 105-108.
- 2004 B. Li, X. Huang, J.Y. Hwang, S. Qu, S. Shi, and Z. Xu, "Acceleration of Microwave Irradiation on the Melting of Fluorides", *AICHe Annual Meeting, Proceedings Fourth World Congress on Microwave and Radio Frequency Applications*, pp. 125-128.
- 2004 S. Shi, J.Y. Hwang, B. Li and X. Huang, "Microwave Sintering of Magnesium Fluoride", *AICHe Annual Meeting, Proceedings Fourth World Congress on Microwave and Radio Frequency Applications*, p. 200.
- 2004 Z. Xu, J. Luo, R. Greenlund, B. Li, J. Hwang, "Controlling Mercury Emissions with Spent Catalytic Converter", *JOM*, v.56, no.11, p.45.
- 2004 Z. Xu, N. Popko, R. Greenlund, J. Hwang, "Recycling of Steel-Making Slag", *JOM* v.56, no.11, p.322.
- 2004 B. Li, J.Y. Hwang, and S. Yu, "Storing Capacity of Copper Ions in Vermiculite and Its Relations to the Preparation Conditions", *JOM* v.56, no.11, p.339.

- 2005 B. Li, J.Y. Hwang and X. Huang, "Effect of Microwave Irradiation on the Characteristics of Bentonite Particles", TMS Annual Meeting, EPD Congress 2005, Edited by M.E. Schlesinger, pp.215-225.
- 2005 J.Y. Hwang and S. Shi, "Novel Perhydrides for Hydrogen Storage", Materials Science and Technology 2005, September, Pittsburgh, PA (accepted).
- 2005 J.Y. Hwang and B. Li, "Low Cost Antibacterial/Antifungal Coating Materials for Homeland Security Applications", Materials Science and Technology 2005, September, Pittsburgh, PA (accepted).

### **Patents and Disclosures**

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- 1989 J.Y. Hwang, "Reagents for Magnetizing Nonmagnetic Materials", U.S. Patent 4,834,898 (Licensed).
- 1990 J.Y. Hwang, "Methods for the Adsorption of Magnetic Reagents", U.S. Patent 4,906,382.
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- "A Method to Separate Mingled Fibers," Michigan Technological File, October, 1989.
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- "A Method to Clean Lubricant Wastes," Michigan Technological University, Filed April 1991.
- "Sintering with Microwave," Michigan Technological University, Filed July 1991.
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- "Rubber-Plastic Composites of Recycled Materials," Michigan Technological University, Filed September 1991.
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- 1984 "Electron Microprobe Study of Diamond ore Minerals," Jack Murphy Associates, PI.
- 1984 "Mineralogical Study of Hudvam Mine Drill Cores," Hudson Bay Mining and Smelting Co., PI.
- 1985 "Fluorine Sources in the Eveleth Ore," Eveleth Mines, PI.
- 1985 "Development and Demonstration of a Flotation System," PI, D.C. Yang, Co-PI, J.Y. Hwang, Dept. of Energy, DE-AC22-85PC81210, \$434,846.
- 1985 "Mineralogy and Liberation Studies of Namew Lake Ni-Cu Ore," Hudson Bay Mining and Smelting Co., PI.
- 1986 "X-ray Diffraction Study of the Tilden Pellet Samples," Cleveland-Cliffs Iron Co., PI.
- 1986 "Mineralogical Analysis of Namew Lake Ore Flotation Products," Hudson Bay Mining and Smelting Co., PI.
- 1986 "SEM Examination of Process Samples," Peinsula Copper Industries Inc., PI.
- 1986 "Gold Occurrence of Farley Lake Ore," Hudson Bay Mining and Smelting Co., PI.
- 1986 "Petrography of Serpentinites," Langill & Associates, PI.
- 1987 "Titanium Ore Beneficiation," DuPont Co., PI, D.C. Yang, Co-PI, J.Y. Hwang.
- 1987 "Preliminary Evaluation of the Calcining Behavior of Dolomite from the Cedarville Quarry," Michigan Limestone Operations Limited, PI.
- 1987 "Gallium in Bauxite," POBA International, PI.
- 1987 "A Mineralogical and Chemical Study of the Graphitic Lower Slate Member, Michigamme Formation, Marquette and Baraga Counties, Michigan," Michigan Department of Natural Resources, PI.
- 1988 "Surface Magnetic Enhancement for Coal Cleaning," DOE, Contract DE-AC22-88PC88856, \$285,497, PI.
- 1988 "Mixing of Cement-Fly Ash Blends," Michigan Energy and Resource Research Association, PI.
- 1988 "Beneficiation of Gypsum From Flue Gas Desulfurization Product," Georgia Pacific Corp, PI.
- 1988 "Magnetic Separation of TVA Paradise Plant Hydrocyclone Classified FGD Sludge and Their Radioactivity," Georgia Pacific Corp., PI.
- 1988 "Pyrite Occurrences," Process Technology, Inc., PI.
- 1988 "Pathfinder Minerals," I-Chem Research, PI.
- 1988 "Silicon Carbide Whisker Beneficiation with Magnetic Reagent, Lab Study," Advanced Composite Materials Corp., PI.

- 1989 "Mineralogical and Laboratory Beneficiation Studies on FENI Nickel Ore from Kavadarci, Yugoslavia," Falconbridge, Ltd., PI.
- 1989 "Pilot Plant Study of SiC<sub>w</sub> Purification Using Magnetic Reagent," Advanced Composite Materials Corp., PI.
- 1989 "Diamond Exploration," Crystal Exploration, Inc. (DOW Chemical), PI.
- 1989 "Mineralogical Analysis of an Ore," I-Chem Research, PI.
- 1989 "Automobile Shredding Residues Study," NIMCO Shredding, \$250,000, PI.
- 1989 "Coal Column Flotation Round Robin Tests and Cost Data Analysis," Kaiser Engineers, Inc., PI.
- 1989 "Olivine and Garnet Mineralogical Study," Carl Brink and Associates, PI.
- 1989 "Leaching Products Characterization," Peninsula Copper Industries, Inc., PI.
- 1990 "Lubricant Cleaning and Recycling Process Development," Alcan, PI.
- 1990 "Phosphorous Occurrences Study," LTV Steel, PI.
- 1990 "Mineralogical Study of Phosphorous in Some Iron Ores," Pickands-Mather, PI.
- 1990 "Talc Ore Study," Pfizer, Inc., PI.
- 1990 "Implant Sample Characterization," Bio-Coat, Inc., PI.
- 1990 "Attapulgitic Clay Study," ARO Products, Inc., PI.
- 1990 "Pilot Scale Advanced Flotation," Department of Energy/ICF Kaiser/Process Technology, Inc., DE-AC22-88PC88881, \$74,277, PI.
- 1990 "Michigan Basin Regional Aquifer Systems Analysis," U.S. Geological Survey, Contract No. 14-08-0001-23528, \$28,876, PI.
- 1990 "Advanced Cycloning Technology Development," Department of Energy/Coal Technology Corp./Process Technology, Inc., DE-AC22-90PC90177, \$85,965, PI.
- 1991 "Magnetic Properties of IGC Ferrofluids," Coal Technology Corp., PI.
- 1991 "Anatase Evaluation," Mineral Technology International, Inc., PI.
- 1991 "Steel Foundry Sand Reclamation Process Development," Michigan Department of Commerce and Natural Resources, \$292,564, PI.
- 1991 "Heavy Liquid Filtrate Study," Coal Technology Corp., PI.
- 1991 "Magnetic Reagent Preparation and Safety Datasheet," EXPORTech Co., Inc., PI.
- 1991 "Column Flotation Exploratory Research" Mineral Technology International, Inc., PI.
- 1991 "Washing Fluid Study," Materials Processing Analytical Services, PI.
- 1991 "Recovery of Coal Fines from Preparation Plant Effluents," Illinois State Geological Survey, Center for Research on Sulfur in Coal, \$109,549, PI.

- 1991 "Development of Technical Information for Selected Deposits, Mines, Beneficiation Plants, and Extraction Plants in China," U.S. Bureau of Mines, Contract JO219006, \$236,264, PI.
- 1992 "Rutile Ore Study," Mineral Technologies International, Inc., PI.
- 1992 "Clean Up Study of Cold Rolling Mill Lubricant," Alcan Rolled Products, PI.
- 1992 "Filtration Products Evaluation," Coal Technology Corp., PI.
- 1992 "Kraft Paper Wastewater Discoloring," Calgon Corp., PI.
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- 1992 "Fly Ash Processing and Utilization," Michigan Department of Natural Resources, Contract MDRD-1-31-20025, \$285,770, PI.
- 1992 "Tire and Wood Fiber Composites Technology Development," Michigan Department of Natural Resources, Grant MDRD-1-31-20024, \$260,350, PI.
- 1992 "Pyromet Process Development for Plating Waste Sludges, Phase I," Envirite Corp., PI.
- 1992 "Fine Coal Cleaning Using Coarsely Packed Column," Mineral Technologies International, PI.
- 1992 "Concrete Application for Magnetic Sand Waste from Steel Foundries," DOE Innovative Concepts Program, Contract DEFG5192R0202, \$19,508, PI.
- 1992 "Mercury Occurrence in Ore," Copper Range Company, PI.
- 1992 "Pyromet Process Development for Plating Sludge Wastes, Phase II," Envirite Corp., PI.
- 1993 "SiC Separation," GM Powertrain, PI.
- 1993 "Alternative Granular Molding Media," U.S. DOE, DE-FC07-93ID13231, \$147,766, PI.
- 1993 "Visual Display of Reservoir Parameters Affecting Enhanced Oil Recovery," Co-PI, U.S. DOE, DE-AC22-93BC14892, \$1,023,103, PI.
- 1993 "Lithium Tungstate Heavy Liquid for Coal Washability," Process Tech., Inc., PI.
- 1993 "Native Copper Ore," Noranda Exploration Co., PI.
- 1994 "Development of Products from Scrap Glasses," Michigan Department of Natural Resources/Acustar/City of Ewart/Consumers Power, \$373,156, PI.
- 1994 "Efficient Materials Utilization," EPA CenCitt, \$50,000, PI.
- 1994 "Recovery of Bypassed Oil in the Dundee Formation Using Horizontal Drains," PI, J. Wood, Co-PI, J.Y. Hwang, U.S. DOE, DE-FC22-94BC14983, \$2,616,818.
- 1994 "Implant Porous Coating," PenTech Bio, Inc., \$62,400, PI.
- 1994 "Ash/SO<sub>x</sub>/NO<sub>x</sub>/Hg Emission Control," Michigan Energy Resources Research Association, Detroit Edison, Consumers Power, \$50,000, PI.

- 1994 "Utilization of Low NO<sub>x</sub> Coal Combustion By-Products," U.S. DOE, DE-FC21-94MC31174, \$865,087, PI.
- 1995 "Development of Laboratory Procedures for Micromag Coal Processing," Custom Coals Corporation/U.S. DOE, \$90,000, PI.
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- 1996 "Utilization of Recycled and Unrecoverable Aluminum Scraps in Manufacturing Cellular Concrete," DOE Innovative Concepts Program, Contract #316708-A-A5, \$22,000, PI.
- 1996 "Automobile Plastics Recycling," VRP and APC, PI.
- 1997 "Dolomite Separation," Chemical Lime Company, PI.
- 1997 "Abrasive Blast Media Treatability Studies," U.S. Air Force, Warner Robins Air Logistics Center, F09650-97-C-0221, \$136,300, PI.
- 1997 "Copper Based Wood Preservatives MEA Solubility Study," Peninsula Copper Industries, PI.
- 1997 "Mineralogical Studies," Great Lakes Calcium Corp., PI.
- 1998 "Low NO<sub>x</sub> Fly Ash," U.S. Department of Energy, \$250,000, PI.
- 1998 "Recycling and Reuse of Aluminum Wastes," U.S. Department of Energy, DE-FC07-98ID13663, \$1,671,486, PI.
- 1998 "Low Cost BioScrubber for Greenhouse Gas Control: Phase 1," U.S. Department of Energy, \$49,615, PI.
- 1999 "Limestone Mineralogy," Great Lakes Calcium, Inc., PI.
- 1999 "Copper Oxide Manufacturing," Peninsula Copper Industries, PI.
- 2001 "Novel Direct Steelmaking by Combining Microwave, Electric Arc, and Exothermal Heating Technologies," U.S. Department of Energy, DE-FC07-01ID14209, PI, X. Huang, Co-PI, J.Y. Hwang, \$599,170.
- 2001 "Verification of Steelmaking Slag Iron Content, Recycle and Reuse of Steel Slags" U.S. Department of Energy, DE-FC07-01ID14046, \$7,934,298, PI. J.Y. Hwang, Co-PI, K. Kawatra.
- 2002 "Grinding Swarf Processing," Cannon-Muskegon Corporation, \$15,057, PI.
- 2002 "Enabling Tool for Innovative Glass Applications," U.S. Department of Energy, DE-FG36-02GO12062, PI, J.M. Gillis, Co-PI, J.Y. Hwang, \$200,000.
- 2003 "Microwave Assisted Electrolyte Cell with Inert Anode and Wetted Cathode for Primary Aluminum Production," U.S. Department of Energy, DE-FC07-02ID14402, PI, X. Huang, Co-PI, J.Y. Hwang, \$375,000.
- 2003 "Polyurethane Characterization", Oshkosh Trucks, \$10,000, PI.
- 2004 "Fly Ash Samples Characterization and Processing", CEMEX International, \$6,250, PI.

- 2004 “Turquoise Materials Processing”, R.T. Research. Corp., \$5,000, PI.
- 2004 “Injection Molding Study of Fly Ash”, CEMEX International, \$10,000, PI.
- 2005 “Preliminary Investigation into Surface Treatment of Talc”, RheTech Inc., \$5,200, PI.
- 2005 “Novel Metal Perhydride for Hydrogen Storage”, U.S. Department of Energy,  
DE-PS36-03GO93013, PI, J.Y. Hwang, Co-PIs, S. Shi, S. Hackney, D. Swenson, \$2,171,234.

**Proposal Review (Recent)**

Department of Energy  
National Science of Foundation  
U.S. Department of Agriculture  
Environmental Protection Agency  
U.S. Civilian Research and Development Foundation  
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Kentucky Science and Engineering Foundation  
Indiana 21<sup>st</sup> Century Research and Technology Fund  
International Copper Association

**Manuscript Review (Recent)**

IEEE Transactions on Magnetics  
International Journal of Mineral Processing  
Journal of Mineral and Metallurgical Processing  
Journal of Materials Processing Technology  
Metallurgical and Materials Transactions A  
CRC Press- Materials Processing Handbook (Book Review)  
Chemosphere  
Waste Management  
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**Magazine/Newspaper Articles Written About Scholarly Work (Recent)**

Science Slashdot, “Microwave Steelmaking”, January 25, 2004  
United Press International, High Beam Research, “Microwaves can make steel fast and cheap”,  
January 29, 2004  
Science Daily, “Microwave Steel: Faster, Cleaner Cheaper”, January 26, 2004  
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NASA Techbriefs, “Steel-Making Process”, January 29, 2004  
Beijing Evening News, “American Professor’s Wild Thought, Microwave Steel for Energy  
Saving, Environmental Protection and Cheaper”, January 30, 2004  
Sina.com Tech News, “Microwave Steel”, January 30, 2004  
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Ottawa Citizen Newspaper, “Microwave Steel”, January 30, 2004  
Canadian Broadcasting Network, “Microwave steel”, January 30, 2004  
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World Journal, “Microwave Steelmaking”, February 27, 2004  
Materials Performance, “Microwaving Steel”, March 2004.  
Machine Design, “Microwave Steel”, April, 2004  
Advanced Materials & Processes, “Microwaves reduce iron ore to iron in a few minutes”, April  
2004  
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Mechanical Engineering, The American Society of Mechanical Engineers, “Zapping Iron”, May 2004  
MarsBlog, “Microwave Steel”, May, 2004  
NBC TV6 News (Marquette), “Jim Hwang, Michigan Tech, Hydrogen Research”, May 10, 2004  
Michigan Tech Alumnus, “Tech Shares in Hydrogen Research Initiatives”, August 2004  
Cutting Tool Engineering, “Steel Measurements, Nugget Know-how”, November, 2004  
Industrial Heating, “Special Focus, Advancements in Microwave Heating Technology”, January 2005

### **Courses Taught**

Materials Recycling  
Environmental Engineering for Materials Processing Industry  
Materials and Energy in Society  
Mine Environmental Engineering  
Mine Safety  
Coal Petrology and Preparation  
Short Course: “New Processes for Manufacturing Light Weight Components”, X. Huang and J.Y. Hwang, IDGA (Institute for Defense and Government Advancement) Lightweight Materials, October 27, 2003.  
Short Course: “New Processes for Manufacturing Light Weight Components”, X. Huang and J.Y. Hwang, IDGA (Institute for Defense and Government Advancement) Lightweight Materials for Auto and Air, May 24-26, 2004.

### **Presentations (recent)**

Department of Energy, “Novel Metal Perhydrides for Hydrogen Storage”, March 2005.  
Cleveland Cliffs Iron, “Microwave Production of Steels”, February 2005.  
TMS Annual Meeting, “Vermiculite”, February, 2005.  
TMS Annual Meeting, “Bentonite”, February, 2005.  
Steel Dynamics, “Microwave Production of Steels”, December, 2004.  
Cleveland Cliffs Iron, “Microwave Production of Steels”, November, 2004.  
NISSAN Automobile, “Perhydride Hydrogen Storage Materials”, October, 2004.  
Structure Engineers Association of Texas, “Microwave Production of Steels”, October, 2004.  
CEMEX International, “Fly Ash Beneficiation and Utilization”, September, 2004.  
Department of Energy, “Recycling and Reuse of Steel Slags”, September, 2004.