Dr. Basudev Swain

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An accomplished researcher in Metallurgy and Material Sciences, Waste Valorization and Circular Economy, Process Optimization and Sustainable Green Process Development, Separation-Purification Technology and Cradle-to-Cradle Technology.
A Resourceful Academic Advisor, Inspiring Lecturer, Engaging Speaker, and Approachable Mentor.

PROFILE SUMMARY

- Persona: Passionate scientist, optimistic-energetic, self-motivated, and disciplined professional. Excellent project/personnel manager in the multicultural, multinational, and multilingual culture.
- Experience: Fourteen years of R&D experience as a faculty/scientist/researcher at world-class university/organizations; Indiana University Southeast, USA, National Institute of Advanced Industrial Science and Technology (AIST) Japan, Korea Institute of Geoscience and Mineral Resources (KIGAM), Korea, A*STAR, Singapore, and Institute for advanced engineering (IAE), Korea.
- Project managed/handled: Co-investigator/researcher manager/project leader of 18 projects**.** Possess solid experience in coordinating and managing different projects in a diverse environment.
- Academic accomplishments: Publication SCI(E) journals (60), national journals (10), peer-reviewed conference proceeding (36), and conference abstracts (29), book chapter (2), patent (3).
- Management and consultancy: A decade of experience in providing consultancy, administrative assignment, sphere heading junior scientists, and management of non-scientist personnel.
- Teaching and mentoring: Three (3) years of teaching and training experience at university, and nine (9) years of experience of mentoring and micro-managing junior scientists/researchers.

MAJOR PROJECTS MANAGING/HANDLING/EXPERIENCE (FOR DETAIL LOOK INTO ANNEXURE-I)

[1] Development and commercialization of waste display disassembly/sorting automation device and LCD / LED waste glass detoxification/ recycling commercial system (5 TPD-class integrated demonstration plant).

[2] Commercial process development for recycling of waste lithium-ion-battery and recovery of 4N pure cobalt.

[3] Commercial process development for the treatment of ITO etching wastewater and recovery of 4N grade pure indium/industrial grade Cu nano-powder (1 TPD-class integrated batch operated demonstration plant).

[4] Commercial process development (value-added industrial production of 4N grade or more) for recovery of tantalum from tantalum metal scrap materials (ongoing project, pyro-hydrometallurgy hybrid process).

[5] Eco-friendly process development for critical rare earth metal (REM) separation and purification technologies: management for cost reduction technology.

[6] Development of high-grade TiO_2 powder manufacturing technology for coating from ilmenite containing 50% TiO_2.

[7] Recovery of valuable materials and detoxification of toxic substances from LED waste (ongoing project).

SCIENTIFIC AND SCHOLARLY ACHIEVEMENTS (FOR DETAIL LOOK INTO ANNEXURE-II & III)

- Managed international collaboration as project leader and act as panelist/reviewer for scientific foundations, mainly EU-NRF (Korea) and QNRF (Qatar), respectively.
- Provide consultancy services for industrial projects managed by Korea Institute of Geoscience and Mineral Resources (KIGAM), Korea, and Sung Shin-University, Korea.
- Managing/managed/handled/worked as project investigator/research manager for more than 18 projects (several hundred thousand to multimillion-dollar projects).
- Primary/principal/senior authored 50 SCI(E), secondary authored 9 SCI(E), international journal publications mainly on E-waste valorization, circular economy, waste management, urban-mining, sustainable process development. Patents granted/applied (3).
- Authored 10 papers in peer-reviewed referred national journals, 36 international conference proceedings, and 29 international conference abstracts of highly recognized scientific society (Mostly in international societies/conferences, awarded for several presentations).
- Dozens of conferences speaker (a couple of them won the best award) and invited speakers.

SIGNIFICANT CONTRIBUTION AND CREATIVITY (FOR DETAIL LOOK INTO ANNEXURE-IV)

[1] Commercial valorization process developed for e-wastes like; LIB, LED, ITO, LCD, MOCVD, LTCC, and Chips

[2] Flexible/versatile mass-production capable process developed to treat ITO etching (industrial) wastewater.

[3] Commercial valorization process for PVB recycling from end-of-life product of automotive (laminated glass).

[4] Marketable nano-material synthesis: Co, Cu, Core-shell TiO_2-SiO_2 and WC-Co, Cd-Se quantum dots.

[5] Metallurgical process developed: Zn from the insoluble anode-based and Ta from capacitor industry waste.

AWARDS AND ACHIEVEMENTS

JSPS Fellowship	Japan Society for the Promotion of Science (JSPS) Postdoctoral Fellowships	**2009**
KOSEF Fellowship	Korea Science Engineering Foundation Fellowship (KOSEF) for Ph.D. studies.	**2004**
UGC-CSIR-NET	Qualifying test for teaching positions/fellowship in Indian universities.	**2000**
Excellent Paper and Poster	Four excellent or best paper award from different international scientific or engineering societies.	**2004-2021**

EDUCATION

Postdoctoral Fellow	National Institute of Advanced Industrial Science and Technology (AIST), Tsukuba, Ibaraki 305-8569, Japan **Project:** Recovery of rare earth metals from scrap luminophore lamps by non-dispersive solvent extraction	**Nov 2008 –Jan 2010**
Postdoctoral Fellow	Korea Institute of Geoscience and Mineral Resources (KIGAM), 124, Gwahak-ro, Yusung-Gu, Daejeon, 34132, Korea. **Project:** Development of fusion technology for the manufacturing of value-added products from precious metal resources	**Nov 2007 -Nov 2008**
Ph.D. (Chemistry)	Analytical Chemistry, Chungnam National University, Daejeon, Korea **Project:** Commercial process developed for lithium-ion battery (LIB) recycling	**Mar 2004 -Aug 2007**

EXPERIENCE, EXPERTISE, AND QUALIFICATIONS (FOR DETAIL LOOK INTO ANNEXURE-V)

Total 19+ years of hands-on research experience after M.S. in academia, government, and industry in 5 different countries, 5 different cultures, 3 different languages: the commons are accomplishments.

Senior Researcher	Material Science & Chemical Engineering Team, Advanced Materials & Processing Center, Institute for Advanced Engineering (IAE), Korea **Responsibilities:** Spearheading a couple of research projects, research management, project micro-management. Directly involved in 18 several thousand to multimillion-dollar projects from proposal to report.	**June 2013 - Continue**
Scientist	Materials Science Laboratory, Data Storage Institute (DSI): Agency for Science, Technology, and Research (A*STAR), Singapore **Responsibilities:** Managed the Chemistry laboratory of DSI	**May 2012 - Oct 2012**
Visiting Faculty	Department of Chemistry, Indiana University Southeast, New Albany, IN 47150, USA. **Responsibilities:** Teaching 40%, research 40% and administration 20%. **Taught** Analytical and general chemistry**, and spearheaded research project:** Recovery of rare earth metals from electronic waste.	**Jan 2010 -May 2012**
JSPS Postdoctoral Fellow	National Institute of Advanced Industrial Science and Technology (AIST), Tsukuba, Ibaraki 305-8569, Japan. **JSPS Research Project:** Recovery/separation of Eu(III) and Y(III) by hollow fiber supported liquid membrane, Recovery of phosphate ion from electroless nickel plating bath by solvent extraction.	**Nov 2008 -Jan 2010**
Postdoctoral Fellow	Korea Institute of Geoscience and Mineral Resources (KIGAM), 124, Gwahak-ro, Yusung-Gu, Daejeon, 34132, Korea. **Project conducted:** Precious group metals (PGM) recovery from automotive waste. Gold recovery from low-grade resources: chalcopyrite/anode slime/concentrate.	**Nov 2007 - Nov 2008**
Graduate research	Analytical Chemistry, Chungnam National University, Daejeon, Korea **Research focus:** Process development for waste lithium-ion-battery (LIB) recycling and valorization of LIB industry scrap by hydrometallurgy. In general e-waste valorization and its circular economy.	**Mar 2004 -Aug 2007**
Research Fellow	Institute of Minerals and Materials Technology, Bhubaneswar 751013, Orissa, India **Project conducted:** [1] Development and testing of organometallic extractants, Department of Atomic Energy, India. [2] Polymetallic manganese module, Department of Ocean Development, India.	**Nov 2001 -Mar 2004**
Academic Performance Index	Scopus ID# 7005838963; ORCID ID # 0000-0003-2771-8058; Google Scholar ID# Dr. Basudev Swain: **h-index=22, i10-index=38, citations:2366, Average IF=5.62.**	

ANNEXURE-I

PROJECTS MANAGING/MANAGED AS CO-INVESTIGATOR/LEADER

Responsibility	Project/sponsored	Duration, Cost/Year
Project Investigator	**Development of 4N5 grade ultrahigh purity of Molybdenum with high melting point by smelting and refining technology for semiconductor applications from northern country resources**	**Jan 2021 -Dec 2021 $1500000**
Project Investigator	**Development of a commercial system for detoxification/recycling of LCD/LED waste glass and automatic plant for disassembly/sorting of waste displays**, The Korea Environmental Industry & Technology Institute (KEITI) funded by the Ministry of Environment, Republic of Korea.	**Aug 2016 -Apr 2021 $1000000**
Project Investigator	**Development of upcycling technology for low-grade tantalum scraps by integrated hydro- and pyro-metallurgical processes** sponsored by The Korea Evaluation Institute of Industrial Technology (KEIT), which is funded by the Ministry of Trade, Industry, and Energy, Republic of Korea.	**May 2019 -Dec 2021 $750000**
Project Investigator	**Continuous manufacturing technology development for titanium granular metal** sponsored by the Korea Evaluation Institute of Industrial Technology (KEIT), which is funded by the Ministry of Trade, Industry and Energy, Republic of Korea.	**July 2016 -June 2021 $500000**
Project Investigator	**Development of high-efficiency waste asbestos destruction technology** sponsored by the Korea Evaluation Institute of Industrial Technology (KEIT), which is funded by the Ministry of Trade, Industry, and Energy, Republic of Korea.	**June 2018 -Dec 2020 $200000**
Project Investigator	**Development of high-quality TiO_2 powder for white paint from 50% TiO_2 containing ilmenite** sponsored by the Korea Institute of Energy Technology Evaluation and Planning (KETEP), which is funded by the Ministry of Trade, Industry and Energy, Republic of Korea.	**Dec 2015 -Sep 2020 $750000**
Project Investigator	**Titanium chloride manufacturing pilot plant construction and operation Technology Development** sponsored by the Korea Evaluation Institute of Industrial Technology (KEIT), which is funded by the Ministry of Trade, Industry and Energy, Republic of Korea.	**June 2015 -May 2020 $1500000**

Project Investigator	**Demonstration of high purity titanium solder powder for manufacturing of equipment** sponsored by the Korea Evaluation Institute of Industrial Technology (KEIT), which is funded by the Ministry of Trade, Industry, and Energy, Republic of Korea.	**Oct 2019 -July 2020** **$400000**
Project Investigator	**Recovery of valuable metals and detoxification of toxic substances from LED wastes** sponsored by the R&D Centre for Valuable Recycling (Global-Top Environmental Technology Development Program) funded by the Ministry of Environment, Republic of Korea.	**Apr 2019 -Dec 2020** **$120000**
Project Investigator	**Development of third-generation anode for 30% of power saving in electro- refining process from insoluble metal powders** sponsored by the Korea Institute of Energy Technology Evaluation and Planning (KETEP), which is funded by the Ministry of Trade, Industry and Energy, Republic of Korea.	**May 2017 -Dec 2019** **$120000**
Project Leader	**Total recycling of LCD/FPD from waste electrical and electronic equipment (WEEE): planning, strategic exploitation of existing facilities, analysis of existing recycling facilities, processes, industry, and the market for cooperative research** sponsored by NRF, Korean Ministry of Science, ICT and Future Planning and EU, German Federal Ministry of Education and Research.	**Feb 2017 -Jan 2019** **$300000**
Project Investigator	**Development of manufacturing techniques for high purity (3N5) tungsten powder from tungsten (more than 95%)** sponsored by the Korea Evaluation Institute of Industrial Technology (KEIT), which is funded by the Ministry of Trade, Industry and Energy, Republic of Korea.	**May 2016 -Dec 2018** **$450000**
Project Investigator	**Development of commercialization technology of high value-added industrial tantalum material (4N or higher) from tantalum metal scrap** sponsored by the Korea Evaluation Institute of Industrial Technology (KEIT), which is funded by the Ministry of Trade, Industry and Energy, Republic of Korea.	**May 2016 -Dec 2018** **$900000**
Project Investigator	**Recovery of high purity 4N5 grade silver and development of powder production technology of 100 nano class from the byproduct of LTCC manufacturing process**, sponsored by the Korea Energy Technology Evaluation and Planning (KETEP), Republic of Korea.	**May 2016 -Apr 2018** **$100000**

Project Investigator	**Development of an eco-friendly process for rare earth separation and development of management technology for cost reduction** sponsored by the Korea Institute of Energy Technology Evaluation and Planning (KETEP), which is funded by the Ministry of Trade, Industry and Energy, Republic of Korea.	**June 2015 -May 2018** **$1500000**
Project Investigator	**Development of commercialization technology to produce rare metals (Ga, In) with 95% recovery and 99.999% purity from LED waste resources** sponsored by the Korea Global Excellent Technology Innovation of the Korea Institute of Energy Technology Evaluation and Planning (KETEP) granted financial resource from the Ministry of Trade, Industry & Energy, the Republic of Korea.	**Aug 2014 -July 2016** **$62000**
Project Investigator	**Development of Total Recycling Technologies for Flat Panel Display Devices** sponsored by the R&D Centre for Valuable Recycling (Global-Top Environmental Technology Development Program) funded by the Ministry of Environment, Republic of Korea.	**May 2014 -June 2016** **$185000**
Project Investigator	**Recovery of Valuable Materials and Detoxification of Toxic Substances from Waste Smart Glasses for Development of Total Recycling System** sponsored by the Korea Environmental Industry & Technology Institute (KEITI) funded by the Ministry of Environment, Republic of Korea.	**May 2014 -June 2016** **$640000**
Project Investigator	**Recovery of rare metal from Low concentration LCD etching Industry Wastewater the Korea Technology and Information Promotion Agency for SME (TIPA)** sponsored by Ministry of SMEs and Startups, Republic of Korea.	**June 2013 -May 2014** **$60000**
Project Investigator	**Development of Dry TiO_2 Synthesis from (NH_4) $2TiF_6$ (AHFT) Using a Fluidized Bed Reactor** consultancy UNID, A Multinational Company with Korean Origin, http://www.unid.co.kr/eng/index.asp	**July 2013 -May 2014** **$12000**

POST-DOCTORAL/DOCTORAL/PRE-DOCTORAL PROJECTS INVOLVED

[1] **Recovery of rare earth metals from scrap: solvent extraction process development and fundamental studies**, Indian University, USA.

[2] **Recovery of rare earth metals from scrap luminophore lamps by non-dispersive solvent extraction**, sponsored by The Japan Society for the Promotion of Science (JSPS), Japan.

[3] **Minimum Emission from Electroless Nickel Plating Processes**; Sponsored by METI Ministry of Economy, Trade, and Industry, JAPAN.

[4] **Develop fusion technology for manufacturing of higher value-added products from precious metal resources**, Korea Institute of Geoscience and Mineral Resources (KIGAM), Republic of Korea.

[5] **Waste Electronics and Electrical Equipment (WEEE) Recycling: Process development for recycling of Lithium-Ion Battery**, Korea Institute of Geoscience and Mineral Resources (KIGAM), Republic of Korea.

[6] **Recovery of Ammonium sulfate by electrodialysis membrane from the polymetallic manganese nodule process waste stream**, Polymetallic manganese module, interest to Department of Ocean Development (DOD), India.

[7] **Development and testing of organometallic extractants**, Department of Atomic Energy, India

FUNDAMENTAL RESEARCH PROJECT HANDLED WITH SELF MOTIVATION

[1] Recycling Tantalum and Niobium from e-waste or secondary resources
[2] Recycling Germanium from the optical fiber.
[3] Recovery of precious metal from automotive waste.
[4] Recycling LCD/ITO and recovery of Indium and Tin.
[5] Separation of p-and n-type thermoelectric materials from E-waste
[6] Material flows analysis of rare earth metals.

ANNEXURE-II

PEER REVIEWED INTERNATIONAL PUBLICATIONS SCI (E)

[1] **Basudev Swain,** Jae Ryang Park, Yu Jin, Chan Gi Lee, **Assessment of bauxite residue as a secondary resource for rare earth metal and valorization challenges: a perspective,** Resources, Conservation & Recycling Advances, In press.

[2] **Basudev Swain†,** Jieun Lee, Bon Woo Gu, Chan-Gi Lee, Jin-Ho Yoon, **Sustainable valorization of semiconductor industry tantalum scrap using non-hazardous HF substitute lixiviant**, Waste management, Waste Management 144 (2022) 294-302.

[3] **Basudev Swain†**, Jae Ryang Park, Chan Gi Lee, **Industrial recycling of end-of-life vehicle window shield glass by mechanical beneficiation and recovery of polyvinyl butyral,** Journal of Cleaner Production, 2022 (334) 130192.

[4] **Basudev Swain, Red mud: An environmental challenge but overlooked treasure for critical rare earth metals,** MRS Bulletin, March 2022.

[5] **Basudev Swain†,** Ata Akcil, Jae-chun Lee, **Red mud valorization processes and understanding their process chemistry: A review**, *Critical Reviews in Environmental Science and Technology*, 2022 (52(4)) 520-570.

[6] Jieun Lee, **Basudev Swain,** Bon Woo Gu, Chan-Gi Lee, Jin-Ho Yoon, **Value Extraction from Semiconductor Industry Tantalum Scrap through Understanding the Thermodynamics and Chemistry**, *International Journal of Refractory Metals and Hard Materials (IJRMHM),* 2021 (100) 105641.

[7] **Basudev swain,** Duk-Hee Lee, Chan-Go Lee, Kyung-Soo Park, **Detoxification of GaAs bearing waste LED and recovery of metal values through understanding the thermodynamics and**

chemistry: a perspective, *Waste and Biomass Valorization***,** 2021 (12) 2769-2778.

[8] Dongyoon Shin, Hyun-Woo Shim, **Basudev Swain**, Kyung-Soo Park, Chan-Gi Lee, **Facile synthesis of single-phase alpha-tungsten nanopowders from ammonium paratungstate by RF induction thermal plasma and thermochemical reduction,** *Korean Journal of Metals and Materials*, 2020, 58(11), 798-807.

[9] Duk-Hee Lee, Kyung-Soo Park, Chan-Go Lee, **Basudev swain, Facile one-pot synthesis of surface-fluorinated TiO_2 hollow spheres with enhanced photocatalytic activity**, *Journal of Photochemistry & Photobiology, A: Chemistry*, 2020, 400, 112654.

[10] Nak-Kyoon Ahn, Hyun-Woo Shim, Dae-Weon Kim, **Basudev Swain**†, **Valorization of waste NiMH battery through recovery of critical rare earth metal: A simple recycling process for circular economy**, *Waste Management*, 2020, 104, 254-261.

[11] Dongyoon Shin, **Basudev Swain**, Chulwoong Han, Yonghwan Kim, Chan Gi Lee, Kyung-Soo Park, **Comparison of different tungsten precursors for preparation of tungsten nano powders by RF induction thermal plasma**, *International Journal of Refractory Metals and Hard Materials*, 2020 (86) 104995.

[12] Yubin Kang, **Basudev Swain,** Byoungyong Im, Jin-Ho Yoon, Chan Gi Lee, **Dae Guen Kim, Synthesis of zeolite using aluminum dross and waste LCD glass powder: a waste-to-waste integration valorization process**, *Metals,* 2019, 9(12), 1240.

[13] Nak-Kyoon Ahn, **Basudev Swain**†, Hyun-Woo Shim, Dae-Weon Kim†, **Recovery of rare earth oxide from waste NiMH battery by simple wet chemical valorization process**, *Metals,* 2019, 9(11), 1151.

[14] Ata Akcil, Ismail Agcasulu, **Basudev Swain**†, **Valorization of Waste LCD and Recovery of Critical Raw Material for Circular Economy: A review,** *Resources Conservation and Recycling*, 2019 (149) 622-637.

[15] **Basudev Swain**, Jae-Chun Lee, Dae-Guen Kim, Chan-Gi Lee, **Application of hollow fiber supported liquid membrane for extraction of cobalt by Cyanex 272,** *Archives of Metallurgy and Materials*, 2019 (64(3)) 845-850.

[16] Il-Jeong Park, **Basudev Swain,** Dae Weon Kim, Geon-Hong Kim, Deok-Hyun Han, Hang-Chul Jung, **Preparation of nickel nanoparticles using nickel raffinate separated by solvent extraction from the spent $FeCl_3$ etching solution**, *Archives of Metallurgy and Materials*, 2019 (64) 531-534.

[17] **Basudev Swain**†, Chan-Gi Lee, **Commercial indium recovery processes development from various e-(industry) waste through the insightful integration of valorization processes: A perspective**, *Waste management*, 2019 (87) 597-611.

[18] **Basudev Swain**†, Jae Ryang Park, Kyung Soo Park, Chan-Gi Lee, **Synthesis of cosmetic grade TiO_2-SiO_2 core-shell powder from mechanically milled TiO_2 nanopowder for commercial mass production**, *Material science and Engineering C*, 2019 (95) 95-103.

[19] Duk-Hee Lee, **Basudev Swain**, Kyung Soo Park, Chan-Gi Lee, **One-pot wet chemical synthesis of F-doped TiO_2 nanoparticles with enhanced photocatalytic activity,** *Material research bulletin*, 2019 (109) 227-232.

[20] **Basudev Swain**, Hyun-Woo Shim, Chan Gi Lee, **Extraction/Separations of Cobalt by Supported Liquid Membrane: A Review**, *Korea chemical engineering research*, 2019, 57(3), 313-320,

[21] **Basudev Swain**, Chan-Gi Lee, Hyun Seon Hong, **Value recovery from Waste LCD Glass Cullet through Leaching: Understanding the Correlation between Indium Leaching Behavior and Cullet Piece Size,** *Metals* 2018, *8*(4), 235.

[22] **Basudev Swain**, Jae Chun Lee, Chan-Gi Lee, **Valorization of cobalt from waste LIB cathode through cobalt/oxalate and cobalt oxide synthesis by leaching-solvent extract-precipitation stripping**, Archives *of* Metallurgy and Materials*, 2018 63(2) 1037-1042*.

[23] **Basudev Swain,** Mikya Tanaka, **Separation of Yttrium from Europium Using a Hollow Fiber Supported Liquid Membrane with 2-Ethylhexyl Phosphonic Acid Mono-2-ethylhexyl Ester as an Extractant**, *Chemical Engineering and communication 2018 (205), 1484-1493*.

[24] **Basudev Swain†,** Dongyoon Shin, So Yeong Joo, Nak Kyoon Ahn, Chan Gi Lee, Jin-Ho Yoon, **Synthesis of Submicron Silver Powder from Scrap Low-Temperature Co-Fired Ceramic an E-waste: Understanding the Leaching Kinetics and Wet Chemistry**, *Chemosphere,* 2018 (194) 793-802.

[25] **Basudev Swain†, Cost effective recovery of lithium from lithium ion battery by reverse osmosis and precipitation: a perspective,** *Journal of chemical technology and biotechnology, 2018 (93) 311-319*.

[26] **Basudev Swain†**, Dongyoon Shin, So Yeong Joo, Nak Kyoon Ahn, Chan Gi Lee, Jin-Ho Yoon, **Selective Recovery of Silver from Waste Low-Temperature Co-Fired Ceramic and Valorization through Silver Nanoparticle Synthesis**, *Waste management*, 2017 (69) 79-87.

[27] **Basudev Swain**, Duk-Hee Lee, Jun-Sik Kim, Chan-Gi Lee, Dong-Wan Kim, Kyung- Soo Park, **Synthesis of flower-like $Cu_3[MoO_4]_2O$ from $Cu_3(MoO_4)_2(OH)_2$ and its application as an anode material for lithium-ion batteries: understand their chemistry**, *Chemelectrochem, 2017 (4) 2608*-2617*.*

[28] **Basudev Swain,** Deokhyun Han, Geon-Hong Kim, Man-Sik Kong, Byungmin Ahn, **Understanding the oxide dispersion behavior of yttria in metal matrix of MA956 alloy through high-energy milling and hot press sintering**, *Archives of Metallurgy and Materials, 2017 (62) 2B 1377-1381*.

[29] Leeseung Kang, HyeLan An, Tae Hyung Kim, Duk-Hee Lee, Kyung-Soo Park, **Basudev Swain,** Chan Gi Lee, Sahn Nahm, **Effect of controlled Mn doping on transition of oxygen vacancies in $Bi_2Ti_2O_7$ thin films: An electrochemical study**, *Applied Surface Science, 2017 (415) 75-79*.

[30] **Basudev Swain**, Duk-Hee Lee, Jae Ryang Park, Chan-Gi Lee, Kun- Jae Lee, Dong-Wan Kim, Kyung- Soo Park, **Synthesis of $Cu_3(MoO_4)_2(OH)_2$ nanoflowers by simple aqueous precipitation: understanding the chemistry and growth mechanism,** *CrystEngComm, 2017 (19) 154-165*.

[31] **Basudev Swain,** Myung Hwan Hong, Chan Hi Lee, **Understanding the isothermal growth kinetics of CdSe quantum dots through microfluidic reactor assisted combinatorial synthesis,** *Journal of Korean Physical Society, 2016 (69) 1485-1492.*

[32] **Basudev Swain**, Myung Hwan Hong, Lee-Seung Kang, Bum-Sung Kim, Nam-Hoon Kim, Chan Gi Lee, **Optimization of CdSe nanocrystals synthesis with a microfluidic reactor and development of combinatorial synthesis process for industrial production**, *Chemical Engineering Journal, 2017 (308) 311-321*.

[33] **Basudev Swain**†, **Recovery and Recycling of Lithium: A Review**, *Separation and Purification Technology, 2017 (172) 388-403.* [**Top 25 Hottest Articles, Hydrometallurgy, 2017-19**].

[34] Sungkyu Lee, Soo-Young Lee, **Basudev Swain**, Sung-Su Cho, **A Validation Experiment on Indium Recovery by Electro-winning of Aqueous Electrolytes: 0.05 M InCl3; 0.05 M InCl3–0.7 M LiCl; 0.05 M InCl3-0.7 M NaCl**, *MP Material testing, 2016 (58) 11-12, 1001-1004.*

[35] **Basudev Swain**, Kun-Jae Lee, **Separation of p-and n-type thermoelectric materials from a semiconductor industry waste by selective chemical dissolution and valorization through synthesis of Bi_2Te_3 nanopowder**, *Journal of chemical technology and biotechnology, 2017 (92) 614-622.*

[36] **Basudev Swain**†, Suk-Hwan Kang, Jin-Ho Kim, Ki-Jin Jung, Young-Don Yoo, Kwang-Jun Kim, Dong-Jun Koh, Jae-Hong Ryu, **Commercial process for mass production of synthetic natural gas through the adiabatic reactors: operational characteristics of a 50kW pilot-plant, influence of steam and CO_2**, *International Journal of Energy Research, 2017 (3) 353-364.*

[37] **Basudev Swain**†**, Separation and purification of lithium by solvent extraction and supported liquid membrane, analysis of their mechanism: a review**, *Journal of chemical technology and biotechnology, 2016 (91) 2549-2562*.

[38] **Basudev Swain**†**,** Chinmayee Mishra, Hyun Seon Hong, Sung-Soo Cho**, Beneficiation and recovery of indium from liquid-crystal-display glass by hydrometallurgy,** *Waste Management, 2016 (57) 207-214*.

[39] **Basudev Swain**†**,** Chinmayee Mishra, Hyun Seon Hong, Sung-Soo Cho**, Selective recovery of pure copper nanopowder from Indium-Tin-Oxide etching wastewater by various wet chemical reduction process: understanding their chemistry and comparisons of sustainable valorization processes,** *Environment Research, 2016 (147) 249-258*.

[40] Da-Woon Jeong**,** **Basudev Swain,** Tae-Yeon Seong, Kyoung-Tae Park, Chan Gi Lee, Bum Sung Kim, **Effect of Amine Additive for the Synthesis of Cadmium Selenide Quantum Dots in a Microreactor**, *International Journal of Applied Ceramic Technology, 2016 (13(2)) 223–227.*

[41] **Basudev Swain**†**,** Chinmayee Mishra, Kun-Jae Lee, Chan Gi Lee, Kyung-Soo Park, **Recycling of GaN a refractory material: understanding the chemical thermodynamics,** *International Journal of Applied Ceramic Technology, 2016 (13(2)) 280–288.*

[42] **Basudev Swain**†**,** Lee Seung Kang, Chinmayee Mishra, JoongWoo Ahn, Hyun Seon Hong, **Materials flow analysis of neodymium, status of rare earth metal in the Republic of Korea**, *Waste Management, 2015 (45C) 351-360*.

[43] **Basudev Swain**†, Jae Layng Park, Dong Yoon Shin, Kyung-Soo Park, Myung Hwan Hong, Hyun Seon Hong, Chan Gi Lee, **Recycling of waste automotive laminated glass and valorization of polyvinyl butyral through mechanochemical separation**, *Environmental Research, 2015 (142C) 615-623*.

[44] **Basudev Swain**†, Chinmayee Mishra, Kyung-Soo Park, Chan Gi Lee, **Valorization of GaN based metal-organic chemical vapor deposition dust a semiconductor power device industry waste through mechanochemical oxidation and leaching: A**

sustainable green process, *Environmental Research, 2015 (140) 704–713.*

[45] **Basudev Swain†,** Chinmayee Mishra, Hyun Seon Hong, Sung-Soo Cho, **Treatment of Indium-Tin-Oxide etching wastewater and recovery of In, Mo, Sn and Cu by liquid-liquid extraction and wet chemical reduction: A laboratory scale sustainable commercial green process**, *Green Chemistry, 2015 (17) 4418-4431*.

[46] **Basudev Swain†**, Chinmayee Mishra, Hyun Seon Hong, Sung-Soo Cho, Sung kyu Lee, **Commercial process for recovery of metals from ITO etching industry wastewater by liquid-liquid extraction: simulation, analysis of mechanism, and mathematical model to predict optimum operational conditions**, *Green Chemistry, 2015 (17) 3979–3991*.

[47] **Basudev Swain†**, Chinmayee Mishra, Lee Seung Kang, Kyung-Soo Park, Chan Gi Lee, Hyun Seon Hong, **Recycling process for recovery of gallium from GaN an e-waste of LED industry through ball milling, annealing and leaching**, *Environmental Research, 138 (2015) 401-408.*

[48] **Basudev Swain,** Chinmayee Mishra, Jinki Jeong, Jae-chun Lee, Hyun Seon Hong, B.D. Pandey, **Separation of Co (II) and Li(I) with Cyanex 272 using hollow fiber supported liquid membrane: A comparison with flat sheet supported liquid membrane and dispersive solvent extraction process,** *Chemical Engineering Journal, 271 (2015) 61-70.*

[49] **Basudev Swain†,** Chinmayee Mishra, Lee Seung Kang, Kyung-Soo Park, Chan Gi Lee, Hyun Seon Hong, Jeung-Jin Park**, Recycling of metal-organic chemical vapor deposition waste of GaN based power device and LED industry by acidic leaching: Process optimization and kinetics study,** *Journal of Power Sources, 281 (2015) 265-271.*

[50] **Basudev Swain,** Hyun Seon Hong, Hang Chul Jung**, Commercial process development for synthesis of spherical cobalt nanopowder by wet chemical reduction reaction,** *Chemical Engineering Journal, 264, (2015), 654-663.*

[51] **Basudev Swain,** Emmanuel E Out, **Competitive extraction of lanthanides by solvent extraction using Cyanex 272: analysis of their classification and mechanism,** *Separation and Purification Technology, 83, (2011) 82-90.*

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ANNEXURE-IV

SIGNIFICANT CONTRIBUTION AND CREATIVITY

INDUSTRIAL PROCESS DEVELOPED:

[1] State of the art process flow sheet for processing of ITO etching waste, and recovery of indium, copper, molybdenum, tin by solvent extraction, cementation, and electrowinning: a fusion process. **Pilot-scale process for handling 1 ton per day.**

[2] State of the art techno-economic green process developed to produce 5N pure cobalt sulfate from the recycling of lithium-ion battery (LIB)/LIB industry manufacturing waste. Can handle p**ilot-scale process in multi-ton capacity.**

[3] Indium recovery from LCD waste, using ITO etching waste as lixiviant by solvent extraction and cementation: **a waste-waste mix stream process**.

[4] Pilot-scale synthesis of copper nano powder from ITO etching waste.

[5] Process for recovery of high purity 4N5 grade silver and development of powder production technology of 100 nano class from the byproduct of LTCC manufacturing process

[6] Developed hydro process for recovery of precious/rare earth/lanthanides from scrap by leaching, chemical treatment, and hydrometallurgy or solution chemistry route.

[7] State of the art process flow sheet for processing of ITO etching waste, and recovery of indium, copper, molybdenum, tin by solvent extraction,

cementation, and electrowinning: a fusion process. **Pilot-scale process for handling 1 ton per day.**

[8] State of the art techno-economic green process developed to produce 5N pure cobalt sulfate from the recycling of lithium-ion battery (LIB)/LIB industry manufacturing waste. Can handle p**ilot-scale process in multi-ton capacity.**

[9] Indium recovery from LCD waste, using ITO etching waste as lixiviant by solvent extraction and cementation: **a waste-waste mix stream process**.

[10] Pilot-scale synthesis of copper nanopowder from ITO etching waste.

[11] Process for recovery of high purity 4N5 grade silver and development of powder production technology of 100 nano class from the byproduct of LTCC manufacturing process

[12] Developed hydro process for recovery of precious/rare earth/lanthanides from scrap by leaching, chemical treatment, and hydrometallurgy or solution chemistry route.

MEMBRANE PROCESS DEVELOPED:

[1] Developed a process for removal of heavy metals and treatment of industrial wastewater by liquid membrane process.

[2] Developed process for recovery of rare earth/lanthanides/heavy metals by hollow-fiber supported liquid membrane and flat sheet supported liquid membrane.

[3] Recover ammonium sulfate from effluent generated after Ni-Co sulfide precipitation in poly metallic nodule processing using reverse osmosis (RO), and electrodialysis (ED) technique.

ENVIRONMENTAL SCIENCES AND MANAGEMENT:

[4] Recycling of waste automotive laminated glass and valorization of polyvinyl butyral through mechanochemical separation.

[5] Valorization of GaN-based metal-organic chemical vapor deposition (MOCVD) dusts a semiconductor power device industry waste through mechanochemical oxidation and leaching.

[6] Recycling technology developed for recovery of values from e-waste like LED, ITO, LCD, MOCVD, LTCC and Chips though sorting, classification, pretreatment, leaching, purification, and recovery route. Mainly hydrometallurgy or chemical metallurgy employed for recovery and valorization through various grade micro/nanopowder synthesis by wet chemical reduction route.

MATERIAL SCIENCES AND CHARACTERIZATION:

[1] Development of combinatorial synthesis process for industrial production of CdSe nanocrystals by the microfluidic reactor.

[2] Synthesis of metal oxide $Cu_3[MoO_4]_2O$ nanopowder for anode material of lithium-ion batteries (LIBs).

[3] Commercial synthesis of nanopowder of cobalt/copper, Cd-Se quantum dots and tungsten carbide coated cobalt nanocomposite for industrial applications.
Trace metal analysis and surface failure analysis of HDD supplied by western digital (WD).

ANNEXURE-V

EXCELLENT PAPER AND POSTER AWARDS

1. Best Presentation Award: The 16th International Symposium on Novel and Nano Materials (ISNNM 2020) held at Phoenix, on November 3-6.
2. Excellent Paper Presentation Award: The Korean society of Industrial Engineering and chemistry, 2017.
3. Best Poster Award: International Union of Materials Research Societies – International Conference on Electronic Materials 2018 (IUMRS-ICEM 2018), August 19(Sun.) ~24(Fri.), 2018 DCC, Daejeon, South Korea.
4. Best Poster Award: International symposium on minerals and materials processing on October 19th, 2004, at Seoul National University, Seoul, Korea.

TEACHING/MENTORING/MANAGEMENT SKILL

- About 3 years of teaching experience in university assigned courses to undergraduates and graduates.
- Experienced in planning course curriculum and assessing students' progress for 6 semesters.
- Profound knowledge of student assessment process
- Deep knowledge of instructional methodologies
- Experienced in designing, managing student project.
- Mentor students in their projects.
- Excellence experience managing student seminars, group discussions, and motivational speeches.
- Ability to assist in school administration duties.
- Ability to secure external funds.
- Ability to work effectively with students and faculty.
- Excellent audio-visual instruction material preparation and presentation skill

TRAINING

16th Annual Teaching Symposium: Tools and Technologies for Teaching in the Digital Age, Indiana University Southeast, New Albany, Indiana, 47150, USA.

15th Annual Teaching Symposium: Tools and Technologies for Teaching in the Digital Age, Indiana University Southeast, New Albany, Indiana, 47150, USA.

EXPERTISE

AREA OF EXPERTISE	TECHNICAL EXPERTISE	INSTRUMENT HANDLED	SKILL (Software)
Hydrometallurgy Environ. Chemistry Extractive metallurgy Resources recycling E-waste recycling Separation purification Material flow analysis, Valorization and Green chemistry	Solvent extraction, supported liquid membrane, Electro Dialysis, Reverse osmosis, Nanofiltration, Ultrafiltration, Ion-Exchange, Leaching Adsorption, PIM, CLM etc., solvothermal, and wet chemical	AAS, ICP-AES, ICP-MS, HPLC, GC, GC-MS, XRD, UV-Vis, IR, NMR, SEM, TEM, XRF, XPS, TG-DTA, CE, TOF-SIM etc.	Chem. Sketch, Hyper Chem., Chem. Office, Matlab, Systat, Sigma Plot, Origin, Kaleida graph, Table Curve 2&3 D, End note, MS-Office etc.

material synthesis, material characterization

SOFT SKILL

COMMUNICATION SKILLS	PROFESSIONAL & CREATIVITY	INTERPERSONAL & PERSONAL	LEADERSHIP & INFLUENCING
Public Speaking Clear Communication (Verbal and Written)	Organizational Planning Tech-trend Awareness Process Improvement Strategic Planning	Networking Conflict Resolution Adaptability Tolerance	Team Building Mentoring Supervising Collaborating Facilitation Persuasion

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Note: Some of the referees feel to send or write recommendations directly to the search committee confidentially. They can be contacted directly for recommendations.

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