Curriculum vitae

Dr. AMIT BARNWAL

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Materials Science and Metallurgical Engineering
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RESEARCH ACHIEVEMENT

- 2 US patents on Li-ion battery recycling
- Developed laboratory custom made mineral processing equipment, viz., air and water fluidization setup for separation of metallic and non-metallic from discarded PCBs powder values
- Developed two technologies based on recycling of discarded Li-ion batteries (LIBs) through pyro and hydro-metallurgical route
- Developed eco-friendly processing route for selective extraction of valuable metals such as Li, Co, Mn and Ni with purity of 99 % from assorted end-of-life assorted LIBs through Hydrometallurgy route
- Up scaled the recycling technologies of assorted end-of-life LIBs through hydrometallurgy route from lab scale to proto-type pilot plant scale (TRL-6) for technology demonstration.
- The developed LIB recycling technology has been transferred to fifteen (15) recycling technology.
- Recovered of Co-Ni alloy from end-of-life assorted LIBs through pyro-metallurgy
- Designed and developed indigenous e-waste processing equipment such as Rotary Tilting Furnace (RTF) up to TRL-6 for smelting of discarded PCBs and Automated depopulation System for component removal
- Smelting of discarded PCBs with 1 ton per day capacity in indigenously developed RTF.

PROFESSIONAL EXPERIENCE:

- **Assistant Professor (March 2026 – Continue**) – Materials Science and Metallurgical Engineering (MSME), IIT Hyderabad, Telangana, India, ***Working Area***: Non-Ferrous Extractive Metallurgy, Mineral Processing, Recycling, Recovery of critical and rare earth metals
- **Post-doctoral Researcher (Feb 2024 – Feb 2026)** – Industrial Materials Recycling, Energy and Materials division, Chalmers University of Technology, Göteborg, Sweden, ***Working Area***: Extraction of high purity of critical metal (Mn, Co and Ni) sulphate salts from NMC batteries leached liquor through solvent extraction.
- **Research Scientist (Nov 2022- Feb 2024) -** Centre for Materials for Electronics Technology (C-MET), Hyderabad, ***Working area***: Recovery of precious metals from secondary sources using environment friendly approach, Development of indigenous e-waste processing equipment up to TRL-6, Smelting of shredded PCBs (1 ton/day) through pyro metallurgy
- **Project Scientist (Sept 2020-Nov 2022) -** C-MET, Hyderabad, ***Working area***: Selective extraction of metallic values such as Li, Mn, Co and Ni from end-of-life li-ion batteries, Upscaling the recycling technology up to proto type pilot scale
- **Junior Research Fellow (Aug 2016-Dec2016) -** Jadavpur University, ***Working area***: Mechanical and wear behaviour of eutectic Al-Si alloy

ACADEMIC QUALIFICATIONS:

- **PhD (Jan 2017-Oct 2021)-** IIT Roorkee, India. Metallurgical and Materials Engineering; Dissertation: Recycling of discarded printed circuit boards for the recovery of metallic values
- **M. Tech (July 2014-June 2016)-** Jadavpur University, India. Metallurgical and Materials Engineering; Dissertation: Development of Aluminium Silicon Alloy for Piston Cylinder at High Temperature
- **B. Tech (2008-2012)-** BPUT (EAST) Odisha, Mechanical Engineering

AWARDS AND RECOGNITIONS:

- Recipient of Doctoral scholarship from Ministry of Human Resource Development (MHRD) India during Ph. D. studies Metallurgical and Material Engineering department at IIT Roorkee.
- Qualified National Level Graduate Aptitude Test in Engineering (GATE) in 2013 and 2014.
- Awarded with the esteemed "TEQIP Fellowship" from Department of Science and Technology (DST), Govt. of India for Junior Research Fellow in the Department of Metallurgical and Material Engineering of Jadavpur University.
- Recipient of GATE scholarship for pursuing M. Tech in the Metallurgical and Material Engineering at Jadavpur University.
- Received best performer employee as supporting role in 2024 at C-MET Hyderabad, India.
- Potential reviewer of many prestigious SCI Journals including Elsevier, Resources, Conservation and Recycling, Waste Management, Journal of Sustainable Metallurgy, Separation and Purification Technology, Solvent Extraction and Ion Exchange etc. in the field of recycling technology from primary and secondary resources.
- Appointed as the organizing committee member of international conference Advances in Materials & Processing: Challenges & Opportunities (AMPCO-2017) at IIT Roorkee.
- Actively served as a Post Graduate committee member of National Service Scheme (NSS) at IIT Roorkee.
- District 2nd topper of class 12th (Higher Secondary School Board Examination).

PROFESSIONAL COMPETENCE

- Excellence in working and handling of conventional lab-scale mineral beneficiation instruments
- Extraction of metals from secondary waste through pyro metallurgy and hydrometallurgy approach
- Experienced in working and analysing with characterization instruments
- Experienced in working in modelling statistical software such as Deign Expert, Mni Tab
- Conversant with professional and analytical software: MS-Office, Origin Pro, X-pert high score
- Capable of doing collaborative as well as independent research work
- Ability to adjust the situation and hardworking and self-motivated

TEACHING EXPERIENCE

❖ **Teaching Assistant, IIT Roorkee**

➢ **Mineral Processing (MT 314), Non-Ferrous Metallurgy (MTN 206)**

− Attending the theory classes and Preparation of lecture notes

− Grading of homework assignments and preparation of model solutions for homework problems

− Organizing laboratory classes for the students and demonstration of laboratory procedures for a class of 100 undergraduate students

− Evaluation of mid-term and final examination answer scripts and participation in final grading

TEACHING AREA

- ❖ Fundamental of extractive metallurgy
- ❖ Non-ferrous extractive metallurgy
- ❖ Mineral Processing
- ❖ Iron and steel making
- ❖ E-waste management and their recycling methods

TECHNOLOGY DEVELOPVED

- Selective extraction of valuable metals such as Li, Co, Mn and Ni from assorted end-of-life assorted Li-ion batteries through hydrometallurgy followed by solvent extraction process (Patented) https://www.istem.gov.in/digitalcatalogue/showinfo/TP19766511672.
- Recovery of Co-Ni alloy from end-of-life Li-ion battery through pyro-metallurgy (Patented) https://www.istem.gov.in/digitalcatalogue/showinfo/TP19765163156.

TECHNOLOGY TRANSFERED

- The developed LIBs recycling technology has been transferred to 9+9 recycling industries on 02-06-2023. (https://pib.gov.in/PressReleasePage.aspx?PRID=1929480&fbclid=IwAR0kNk2JyjUwfHBap6PLafjbhYIP8a3gf9qYmjuJT_eC7G3fbMdaU2aFdHU)
- More than 30 industries have shown interest to absorb the developed technology.
- 15 startups have been incubated to train on the developed Li-ion battery recycling technology.

PATENTS

U.S. PATENT

1) Ajay Kaushal, **Amit Barnwal**, Rajesh Kumar Siva Sankaran Nair, Sandip Chatterjee, Ratheesh Ravendran, U.S. Patent on "A method for recovery of metal oxides/carbonates from assorted waste li-ion batteries" (2023); US Patent No- US20230391632A1 https://patents.google.com/patent/US20230391632A1/en
2) Rajesh Kumar Siva Sankaran Nair, Ajay Kaushal, **Amit Barnwal**, Sandip Chatterjee, Ratheesh Ravendran, IPR on "A method for recovery of metals and metal alloys from waste lithium-ion batteries" (2024) US Patent No.- US20240002978A1 https://patents.google.com/patent/US20240002978A1/en

LIST OF PUBLICATIONS IN PEER-REVIEWED JOURNALS

1) Petraglia, N. F., Garjulli, F., Locati, A., Barnwal, A., Petranikova, M., Tenorio, A. J., Espinosa, D. C. (2026). Selective Separation of Rare Earth Elements from Malic-Acid NdFeB Magnet Leachate by Solvent Extraction (**IF- 2.597**) DOI- https://doi.org/10.1007/s11837-026-08173-0
2) **Barnwal, A.**, Locati, A., Mullic, M, Mari, L., Wilson, P. B., Partinen, J., Chernyaev, A., Budhathoki, R., Petranikova M., (2026). Recovery of nickel from the pregnant leach solution of spent NMC batteries using Versatic acid 10 and mixer-settler operations (**IF- 9**). DOI- https://doi.org/10.1016/j.seppur.2026.137059
3) **Barnwal, A**., Bias, P., Balakrishna, M., Rajesh, S. K., Ratheesh, R., Kaushal, A., (2024). Recovery of lithium, cobalt and graphite contents from black mass of LCO based discarded Li-ion batteries, Mining, Metallurgy & Exploration, (**IF- 1.695**). DOI- https://doi.org/10.1007/s42461-024-01043-w
4) Saleem, S., Rao, K Y., **Barnwal, A.,** Kaushal, A., Talari, M K., Kumar, Rajesh S., Ratheesh, R., (2024) Recovery of Co-rich Metal Alloy from End-of-life Li-ion Batteries, Materials today proceedings, DOI: https://doi.org/10.1016/j.matpr.2023.12.060
5) **Barnwal, A**., Balakrishna, M., Bias, P., Rajesh, S. K., Ratheesh, R., Kaushal, A., (2023). Effective methodology for selective recovery of lithium values from discarded li-ion batteries, JOM, **(IF- 2.597)**. **DOI-** https://doi.org/10.1007/s11837-022-05684-4
6) **Barnwal, A**., & Dhawan, N. (2020). Recovery of copper values from discarded random-access memory cards via fluidization and thermal exposure. Journal of Cleaner Production, 256, 120516 **(IF- 11.072). DOI-** https://doi.org/10.1016/j.jclepro.2020.120516
7) **Barnwal, A**., & Dhawan, N. (2020). Recycling of discarded mobile printed circuit boards for extraction of gold and copper. Sustainable Materials and Technologies, 25, e00164 **(IF- 10.681)**. **DOI-** https://doi.org/10.1016/j.susmat.2020.e00164
8) **Barnwal, A**., & Dhawan, N. (2020). Investigation of Discarded Printed Circuit Boards for Recovery of Copper Values. JOM, 72(8), 2983–2992 **(IF- 2.597)**. **DOI-** https://doi.org/10.1007/s11837-020-04113-8
9) **Barnwal, A**., & Dhawan, N. (2020). Physical Processing of Discarded Integrated Circuits for Recovery of Metallic Values. JOM, 72(7), 2730-2738 **(IF- 2.597)**. **DOI-** https://doi.org/10.1007/s11837-020-04137-0
10) **Barnwal, A**., & Dhawan, N. (2019). Evaluation of Fluidization Process for Recovery of Metals from Discarded Printed Circuit Boards. Journal of Sustainable Metallurgy, 5(4), 519-527 **(IF- 3.068)**. **DOI-** https://doi.org/10.1007/s40831-019-00242-w
11) **Barnwal, A**., Mir, S., & Dhawan, N. (2020). Processing of Discarded Printed Circuit Board Fines via Flotation. Journal of Sustainable Metallurgy, 6(4), 631-642 **(IF- 3.068)**. **DOI-** https://doi.org/10.1007/s40831-020-00304-4
12) **Barnwal, A**., & Dhawan, N. (2020). Recovery of Copper Values from Discarded Printed Circuit Boards. Transactions of the Indian Institute of Metals, 73(8), 2015-2023 **(IF- 1.391)**. **DOI-** https://doi.org/10.1007/s12666-020-01916-w
13) **Barnwal, A.,** & Dhawan, N. (2020). Recovery of Metals from Discarded Integrated Circuits. Mining, Metallurgy & Exploration, 37(5), 1641-1651 **(IF- 1.695)**. **DOI-** https://doi.org/10.1007/s42461-020-00249-y

14) Tanvar, H., **Barnwal, A**., & Dhawan, N. (2020). Characterization and evaluation of discarded hard disc drives for recovery of copper and rare earth values. Journal of Cleaner Production, 249, 119377 **(IF-11.072)**. **DOI-** https://doi.org/10.1016/j.jclepro.2019.119377
15) Sunil, S. R., Vishvakarma, S., **Barnwal, A**., & Dhawan, N. (2019). Processing of spent Li-ion batteries for recovery of cobalt and lithium values. JOM, 71(12), 4659-4665 **(IF- 2.597)**. **DOI-** https://doi.org/10.1007/s11837-019-03540-6
16) **Barnwal, A**., Vishvakarma, S., & Dhawan, N. (2018). Comparison of different routes for recovery of metals from electronic scrap. Materials Today: Proceedings, 5(9), 17046-17054. **DOI-** https://doi.org/10.1016/j.matpr.2018.04.111

INTERNATIONAL CONFERENCES:

1) **Barnwal A**, Locati A, Mullic M, Mahti I, Petraglia F, Petranikova M, (2025), Extraction of high purity nickel sulfate from NMC 111 batteries leachate through solvent extraction and crystallization, 24th International Solvent Extraction Conference (ISEC), Melbourne Australia, 29 Sept-3 Oct
2) Locati A, Bordes R, **Barnwal A,** Mahti I, Ekberg C, Petranikova M, (2025), Phase Behaviour of Saponified Cyanex 272 and Counter-Current Extraction of Co(II) From Ni-rich Spent Lithium-ion Batteries Leachate, 24th International Solvent Extraction Conference (ISEC), Melbourne Australia, 29 Sept-3 Oct
3) **Barnwal A,** Kaushal A, Ravendran R, (2022), Selective recovery of lithium and manganese values from discarded coin cell, International conference on Advances in Materials & Processing: Challenges & Opportunities, IIT Roorkee, INDIA, 17-19 Oct 2022.
4) **Barnwal A,** Dhawan N, (2020), Recovery of copper values from discarded printed circuit boards International Conference on Management and Recycling of Metallurgical Wastes, IIT BHU, INDIA, 22-23 Feb 2020.
5) Dhawan N, **Barnwal A,** (2019), Recycling of discarded printed circuit boards, International Conference on Advance in Process Metallurgy, IISc Bangalore, INDIA 4-5 July 2019.

Poster presented in international conferences

1) Barnwal A., kumar S, Vendra S.S., Saleem S., Ravendran R., and Rajesh S., (2023), Recovery of silver from the Mylar circuit sheet of discarded keyboard, International conclave on Materials, Energy and Climate, New Delhi, INDIA 18-21 Dec 2023.
2) **Barnwal A,** Dhawan N, kaushal A, (2022), Recovery of Cu and Au from discarded mobile using mechanical and chemical processing, The Indian Institute of Metals (IIM-ATM), Hyderabad, INDIA, 13-16 Nov 2022.
3) Bias, P., Balakrishna, M., **Barnwal, A.,** Rajesh, S. K., Ratheesh, R., Kaushal, A. (2022), Selective recovery of aluminium, lithium and cobalt from end-of-life li-ion batteries, The Indian Institute of Metals (IIM-ATM), Hyderabad, INDIA, 13-16 Nov 2022.
4) Kaushal A, **Barnwal A**, Ravendran R, (2022), E-waste management: Circular Economy & Resource Efficiency, International conference on Advances in Materials & Processing: Challenges & Opportunities, IIT Roorkee, INDIA, 17-19 Oct 2022.
5) **Barnwal A.,** Dhawan N, (2017), Comparison of different routes for recovery of metals from electronic scrap, International Conference on Advances in Materials & Processing: Challenges & Opportunities, IIT Roorkee, INDIA, 30th Nov-2nd Dec 2017.
6) Vishvakarma S, **Barnwal A.,** Dhawan N, (2017), Recovery of lithium and cobalt from discarded batteries, International Conference on Advances in Materials & Processing: Challenges & Opportunities, IIT Roorkee, INDIA, 30th Nov-2nd Dec 2017.