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# **CURRICULUM VITAE**

**of**

## **Dr. Prince Kumar Singh**

**Department of Metallurgical and Material Engineering**  
**Indian Institute of Technology**  
**Ropar, 140001(INDIA)**

Name: Prince Kumar Singh

Date of birth: August 24, 1987

Place of birth: Azamgarh, Uttar Pradesh (India)

Present position: Assistant Professor,  
Department of Metallurgical and Materials  
Engineering, I.I.TRopar, 140001

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### **Educational qualifications:**

Year	Institution/University	Degree
2010	University Institute of Engineering and Technology, CSJM University, Kanpur	B. Tech (Material Science & Metallurgy Engineering)
2012	National Institute of Technology, Durgapur	M.Tech. (Industrial Metallurgy)
2019	Indian Institute of Technology Kanpur	Ph.D. (Material Science and Engineering)

**Area of specialization:** Physical and mathematical modeling of the steel making process, Recycling of Steel plant waste material, Extractive metallurgy (Ferrous division)

### **Previous positions:**

- (i) Senior Project Engineer, Indian Institute of Technology, Kanpur, UP (01/07/2019 – 29/12/2019).
- (ii) Senior Student Project Associate in the Department of Material Science and Engineering, I.I.T, Kanpur, India (01/01/2019 – 30/06/2019).
- (iii) Assistant Professor (Ad-hoc) in the Department of Materials Science & Metallurgical Engineering, MANIT, Bhopal, (27/01/2013 - 26/12/2013).
- (iv) Management trainee (Quality Control) in Bhushan Steel and Strips Limited, Khopoli Raigad Maharashtra, (09/07/2012 - 26/01/2013).

## Teaching experience:

2019 - till date; at undergraduate level, the following subjects were taught by me:

- (i) Iron and Steelmaking
- (ii) Principle of Extractive Metallurgy
- (iii) Modelling and Simulation
- (iv) Transport Phenomena
- (v) Iron and Steel Industry: Operations and equipment

## Professional Awards

- 1. Best Technical Paper “DuraBI Conference” 2021.
- 2. IIM-SAIL GOLD 2020 Medal “Indian Institute of Metal” 2020.

## Undergraduate/Postgraduate research Supervision

### **B. Tech**

- 1. Pranjal: Thesis topic. “Ensemble machine learning-based algorithm for prediction of hydrogen reduction during steelmaking process.” **(Ongoing)**
- 2. Sugam: Thesis topic. “Solid stage reduction of Electric Arc Furnace and used for internal industrial application.” **(Ongoing)**
- 3. Suyash Varshne; Thesis topic. “A thermochemical model is being developed to assess the efficiency of the EAF.” **(Ongoing)**
- 4. Charwak Bhushan Ambade; Thesis topic. “Recycling of steel slag from different station in steel plant for potential application.”
- 5. Vedant (2022); Thesis topic. “Development of a thermo chemical model for assessing EAF performance.”
- 6. Gaurav Maurya (2022); Thesis topic: “Estimation of grade intermixing time in tundish during ladle changeover operation”.
- 7. Kola Balakrishna (2022); Thesis topic: “Design Optimization of Tundish using Residence Time Distribution Data”.

### **PhD**

- 1. Abhinav Maurya (2020-till now): Thesis topic: “Multiphase flow behavior in tundish and the corresponding effect on steel cleanliness”. **(Ongoing)**
- 2. Sheshang Singh Chandel (2020-till now): Thesis topic: “Recycling of waste Electric Arc Furnace for potential applications”. **(Ongoing)**
- 3. Prem Chandra Sinha; ERP Candidate (2021-till now): Thesis topic: “Casting parameters and casting defect formation in steel” (Co-Supervisor: Prof. Ravi Mohan Prasad). **(Ongoing)**
- 4. Awnish Prasad Singh Part-time Candidate (2021-till now): Thesis topic: “Design of sub-entry nozzle to optimize steel behavior inside the mold during continuous casting”. **(Ongoing)**

5. Sambit Tripathy (2023-till now): Thesis topic: “Recycling of steel slag for internal applications.” (**Ongoing**)

### **Sponsored Research:**

1. “**Roll of ladle Shroud design on hydrodynamic performance of tundish.**” Sponsored by IIT Ropar through **ISRD Phase-1** (7 lakhs)
2. “**Assessment of tundish hydrodynamic performance.**” sponsored by **Aarti Steel Cuttack Odisha India** (2.5 Lakhs)
3. “**Quality assessment of Galvanized iron profile sheet**” sponsored by **Punjab state warehouse cooperation, Govt. of Punjab** (23.40 Lakhs)
4. “**Development of ultra-high hardness steel through grain refinement for automotive and defense industries: A novel approach**” sponsored by **Core Research grant, SERB ANRF** (50.55 lakhs)
5. **Solid state recycling of copper scrap: A sustainable approach for producing high strength, high conductivity copper wire.** Sponsored by **Ministry of Mines, GOI** (₹ 53.76 Lakhs) [**Ongoing**]

### **Publication summary of (Dr. Prince Kumar Singh):**

#### **(i) Book chapters:**

1. Sheshang Singh Chandel, Abhinav Maurya, Navneet Singh Randhawa, **Prince Kumar Singh**. “Iron Recovery Approach from Steel Slag Using Droplet Coalescence Technique” Springer Nature Singapore (2024): 21-27.
2. Charwak Ambade, Sheshang Singh Chandel, and **Prince Kumar Sing**.” Reduction Kinetics of Composite Steel Slag-Coke Pellets.” Springer Nature Singapore (2023): 52-57.
3. Abhinav Maurya, Prvan Kumar Katiyar and **Prince Kumar Singh**: “An Overview of the Mathematical Modelling of Reheating Furnaces.” IIP Series (2024): 110-139.
4. Abhinav Maurya, Prvan Kumar Katiyar and **Prince Kumar Singh**: “An Overview of the Numerical Modelling and Monte Carlo Simulation of Reheating Furnaces” IIP Series (2024): 78-109.
5. **Prince K. Singh**, Subham Ranjan, and Dipak Mazumdar: Gas-liquid flows in ladle shroud and their impact on tundish process performance and steel quality: Springer, Singapore (2018) (Online ISBN •978-981-10-7892-7).

## (ii) Publications in referred journals

1. Abhinav Maurya, **Prince Kumar Singh**, "Internal gas injection into ladle shroud and improvement in tundish hydrodynamic performance", Steel Research International (Under review)
2. Sheshang Singh Chandel, Navneet Singh Randhawa, **Prince Kumar Singh**, "Investigations on Kinetics and Mechanism of Solid-State Carbothermic Reduction of Electric Arc Furnace Slag", Journal of thermal analysis and calorimetry (Under Review)
3. Sheshang Singh Chandel, Navneet Singh Randhawa, **Prince Kumar Singh**, "Reduction and Metal Separation Behavior of Iron-Rich Slag in Potential Recycling by Electric Arc Furnace Smelting," Journal of sustainable metallurgical (2024) (Accepted)
4. Sheshang Singh Chandel, Prvan Kumar Katiyar Navneet Singh Randhawa, **Prince Kumar Singh**, "A Review on Environmental Concerns and Technological Innovations for the Valorization of Steel Industry Slag." Mining, Metallurgy & Exploration (2023): 2059-2086
5. Sarangi, Soumya Sourav, Avala Lavakumar, **Prince Kumar Singh**, Prvan Kumar Katiyar, and Ranjit Kumar Ray. "Indentation size effect in steels with different carbon contents and microstructures." Materials Science and Technology (2022): 1-9.
6. Katiyar, Prvan Kumar, Rita Maurya, and **Prince Kumar Singh**. "Highlighting the corrosion mechanisms of corroded plain carbon steels using the atomic force microscopy." (2022): 198-220.
7. Katiyar, Prvan Kumar, Rita Maurya, and **Prince Kumar Singh**. "Corrosion behavior of plain carbon steels under different heat treatment conditions in freely aerated 3.5% NaCl solution." (2022): 44-68.
8. Aman Verma, Himanshu Yadav, Kuldeep Kumar, **Prince Kumar Singh**, Mayank Sharma, Vishal Shankar Srivastava, Ashish Kumar Srivastava, State of Art on Microstructural and Mechanical Characterization of Wire and Arc Additive Manufacturing (WAAM), Computational and Experimental Methods in Mechanical Engineering 2022, 93-104.
9. Prvan Kumar Katiyar, Rita Maurya, and **Prince K. Singh**, "Failure Behavior of Cemented Tungsten Carbide Materials: A Case Study of Mining Drill Bits", Journal of Materials Engineering and Performance, Journal of Materials Engineering and Performance, 21, 2021, 1- 17.
10. Rohit Tiwari, **Prince K Singh**, Ankur Agnihotri and Dipak Mazumdar; Shrouded transfer of molten steel from a ladle to tundish: thermal modelling and industrial scale measurements; AIST Transactions, Vol.16, No.2, 2019, pp. 1-16.
11. **Prince K. Singh** and Dipak Mazumdar, "Mathematical modelling of gas-liquid two flows in ladle shroud", Metallurgical and Materials Transactions B, (2019), 50, 1091-1103.
12. **Prince K. Singh** and Dipak Mazumdar, "A physical model study of two phase, gas -liquid flows in ladle shrouds and applications to industrial scale, ladle to tundish transfer operation" Metallurgical and Materials Transactions B, (2018), 49(4), 1945-1962.
13. D Mazumdar, **Prince K Singh**, Rohit K Tiwari: "Shrouded transfer of molten steel from ladle to tundish: current understanding, mathematical modelling and new insight", ISIJ, (2018), 58(8), 1545–1547.
14. Ankur Agnihotri, **Prince K Singh**, Rishikesh Mishra and Dipak Mazumdar: Steady state materials and enthalpy balance: applications to ferroalloy production and industrial scale validation, Trans Indian Inst Met (2019), 72(2), 455-472.
15. **Prince Kumar Singh**, Prvan Kumar Katiyar, Rita Maurya, Avala Lava Kumar, "Agglomeration behavior of steel plants solid waste and its effect on sintering performance", "Journal of Materials Research and Technology", (2017), 6(3), 289-296.
16. **Prince Kumar Singh**, Prvan Kumar Katiyar, Avala Lava Kumar, Dinesh Kumar Mishra

- Ajit Behera, "Agglomeration behavior of solid waste materials in steel plants", *Emerging Materials Research*, (2016), 5(1), 171-176.
17. Prvan Kumar Katiyar, **Prince Kumar Singh**, Rityuj Singh, A. lava Kumar, "Modes of failure of cemented tungsten carbide tool bits (WC/Co): A study of wear parts", *International Journal of Refractory Metals and Hard Materials*, (2014), 54, 27–38.
  18. A. Lava Kumar, Ch.V.S Murthy, **Prince Kr Singh**, Bhargav Chaithanya and Shiva Kumar, "Property enrichment of aged nickel base superalloy Supercast 247A", *International Journal on Theoretical and Applied Research in Mechanical Engineering (IJTARME)*, (2013), 2(4), 115- 120.

### (iii) Publications in peer-reviewed conference proceedings:

1. Sheshang Singh Chandel, Navneet Singh Randhawa, **Prince Kumar Singh**. "Thermodynamic and kinetic aspect of solid state reduction of Electric Arc Furnace slag through coke: An experimental study." *Materials Today: Proceedings* (2023).
2. Sheshang Singh Chandel, Abhinav Maurya, and **Prince Kumar Singh**. "Numerical investigation of quenching technique for steel alloy hardening process using twins liquid jets." *Materials Today: Proceedings* (2022).
3. Suvam Mukherjee, **Prince Kumar Singh**, and Dipak Mazumdar: "Ladle shroud performance enhancement: a process modeling investigation & quot;, *Proceeding, IREFCON-2020 (Kolkata)*, published.
4. Dipak Mazumdar, **Prince Kumar Singh**, Rishikesh Mishra and Krashnavtar: "Simulation of steelmaking processes: an assessment of reduced and full-scale water modelling, numerical simulation vis a vis plant scale measurements&quot;, *Proceeding., STEELSIM2019 (AIST), Toronto, Canada, Aug. 13-15<sup>th</sup> , 2019*, pp.769-779.
5. Rohit K Tiwari, **Prince K Singh**, Dipak Mazumdar: Molten steel – refractory interface: Thermal resistance estimation and industrial scale measurements, *NMD ATM 2018, 14<sup>th</sup> – 16<sup>th</sup> November 2018, Kolkata, India (Presented on 15<sup>th</sup> December 2018 in Process Metallurgy session)*.
6. **Prince K Singh**, Rohit K Tiwari, Dipak Mazumdar, Abhishek Dutta: Modelling of two phase, gas-liquid flows in ladle shroud "7<sup>th</sup> International congress on science and technology of steelmaking", *Published in proceeding of ICS2018 (Presented on 13 th June 2018 at Venice, Italy)*.
7. A. Agnihotri, M. Gupta, **Prince K Singh**, D. Singh, S.S. Tippannavar, S.K. Tuli: Effect of foamy slag in electric arc furnace on energy efficiency, *7th International congress on science and technology of steelmaking", Published in proceeding of ICS2018 (Attended on 14<sup>th</sup> June 2018 at Venice, Italy)*.
8. **Prince K. Singh** and Dipak Mazumdar: "Macroscopic modeling of argon-steel flows inside a ladle shroud", *Published in proceeding of STIS17, IIT Kanpur, India (Presented on 13 th December 2017 at IIT Kanpur)*.
9. **Prince Kumar Singh**, P.K.Katiyar, A.LavaKumar, N Bhargava Chaitanya and S. Pramanik "Effect of Sintering Performance of the Utilization of Blast Furnace Solid Wastes as Pellets", *Published in proceedings, Procedia Materials Science of Elsevier Ltd, Vol.5, 2014, pp2468- 2477 ( Presented at AMME 2014)*.
10. A Lavakumar, N Bhargav Chaitanya, B Shiva Kumar, Virinchi Sainath and **Prince Kr Singh** "Study of Tensile Fracture Mechanisms of a Ni-based superalloy supercast 247A" *Published in proceedings, Procedia Materials Science under Elsevier Ltd, , Vol.5 pp1090-1096. (Presented at AMME 2014) (Available online)*.

11. A. Lava Kumar, **Prince Kr Singh**, Sanjay Srivastava, Suraj Kori and Ajay Kumar “Gamma prime coarsening behavior of nickel superalloy supercast 247A after prolonged thermal exposures” 2<sup>nd</sup> National conference on Recent developments in mechanical engineering, (RDME’2013) April 26-27, 2013 Pune, Published in Journal: IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) ISSN (e): 2278- 1684, ISSN (p): 2320–334X, PP: 37-42.

#### (iv) Conference presentation/posters

1. Sheshang Singh Chandel, Abhinav Maurya, **Prince Kumar Singh** and Navneet Singh Randhawa: Iron recovery approach from steel slag using Droplet Coalescence Technique .International Conference on Fundamental and Industrial Research in Materials December 2023. (IIT Ropar).
2. Abhinav Maurya, Sheshang Singh Chandel and **Prince Kumar Singh**: A novel approach to reduce the tundish open eye using snorkel and its corresponding effect on tundish hydrodynamic performance, International Conference on Fundamental and Industrial Research in Materials December 2023. (IIT Ropar)
3. Sheshang Singh Chandel, **Prince Kumar Singh** and Navneet Singh Randhawa: Thermogravimetric study of Electric Arc Furnace Slag, International Conference on Metallurgical Engineering and Centenary Celebration October 2023. (IIT BHU).
4. Charwak Ambade, Sheshang Singh Chandel and **Prince Kumar Singh**, Reduction Kinetics of Composite Steel Slag-Coke Pellets, International Conference on Metallurgical Engineering and Centenary Celebration October 2023. (IIT BHU).
5. Abhinav Maurya and **Prince Kumar Singh**: Effect of Internal Gas Injection in Various Shroud Geometry and Influence on Tundish Hydrodynamic Performance, 4<sup>th</sup> International Conference on Science and Technology of ironmaking and steelmaking December 2022 (IIT Bombay).
6. Sheshang Singh Chandel, **Prince Kumar Singh**, Navneet Singh Randhawa and Prem Chandra Sinha: Effect of CaO content on crystallization behavior of EAF slag under different cooling environment, 4<sup>th</sup> International Conference on Science and Technology of ironmaking and steelmaking December 2022 (IIT Bombay).
7. Sheshang Singh Chandel, **Prince Kumar Singh** and Navneet Singh Randhawa: Studies on Physicochemical and Toxicity Characterization of Electric Arc Furnace Slag. Valorization of Fly Ash & Steel Slag: Challenges, Innovations & Future Trend: September 2022.
8. Abhinav Maurya and **Prince Kumar Singh**: Internal Gas Injection in Shroud and Influence on Tundish Hydrodynamic Performance, 8<sup>th</sup> International Congress on the Science and Technology of Steelmaking August 2022, Canada.
9. Sheshang Singh Chandel, Prem Chandra Sinha and **Prince Kumar Singh**: Behavior of Electric Arc Furnace Slag under Different Cooling Conditions and Its Environmental Impact, 8<sup>th</sup> International Congress on the Science and Technology of Steelmaking August 2022, Canada.
10. Abhinav Maurya, Ankur Agnihotri and **Prince Kumar Singh**: Effect of Shroud Geometry on melt residence in steelmaking Tundish System, 75 th Annual Technical Meeting (ATM), 59 th National Metallurgists day (NMD) November 2021.
11. Sheshang Singh Chandel, Ankur Agnihotri, Prem Kumar Sinha, **Prince Kumar Singh**: Investigation of ERF slags under various cooling environments and their leaching behaviors, 75 th Annual Technical Meeting (ATM), 59 th National Metallurgists day (NMD) November 2021.
12. Arun Kumar, A. Lavakumar, **Prince K. Singh** and S. K. Badjena “A review on Metallic Foams” [Poster presented in national conference on “Behind the teachers’ desk-2015” (April 9<sup>th</sup> -10<sup>th</sup>) in CSIR –NML Jamshedpur. - won 2<sup>nd</sup> best poster award.

13. **Prince Kumar Singh**, P.K. Katiyar, A. Lava Kumar and S. Pramanik, “Recycling of blast furnace flue dust and sludge used as pellets in sintering” (Presented at NMD ATM 2013 at IIT BHU).
14. A.Lavakumar, **P.K.Singh**, P.K.Katiyar, T.Trinath and A.K.Jaiswal, “Archaeo metallurgical studies of the ancient sword” (NMD ATM 2014, 12 th – 15 th November 2014, College of Engineering, Pune).
15. A.Lava Kumar, **Prince Kr Singh**, Rabindra Kr Rai and Sanjay Srivastava “Measurment of thermo physical properties of nickel-base superalloys”, International conference on metallurgical manufacturing and mechanical engineering (ICMMME’13), April 30th 2013.
16. A Lava Kumar, **Prince Kumar Singh**, M. Sai Krishna Rao, Ch.V.S Murthy, N. Eswara Prasad “Boronising behavior of Nickel and Iron Nickel base alloys” (Poster presented in 10 th International Symposium on surface protective coatings (SSPC India 2013) on Feb 15 th & 16 th , 2013), Mumbai (India).

## Invited Lectures

1. Topic: **Steelmaking and Refractories; A residential**, three-day continuing education program; Department of Materials Science &Engineering; IIT Kanpur on 18<sup>th</sup> Jan 2023.
2. Topic: **Role of Modelling in steelmaking: Current insights & Limitations** Department of Materials Science & Metallurgical Engineering IIT Bombay on 11<sup>th</sup> Jan 2022.
3. Topic: **Cracking in strand casting causes and Remedies**; Five days online STTP on Aspects of Continuous Casting of steel (ACCS-21), VNIT Nagpur Maharashtra INDIA on 26<sup>th</sup> Nov 2021.
4. Keynote lecture on Casting of liquid steel: **Processing steps: effects & corresponding defects**: AFTMME IIT ROPAR (December 9-11, 2021)
5. Keynote lecture on the **Conceivable implication of melt transfer on its cleanliness through shroud from ladle to tundish – An insight to flow characteristics**: International Conference on Advancements and Futuristic Trends in Mechanical and Materials Engineering (December 19-20, 2020).
6. Delivered a talk on the Role of modeling in steelmaking: **Current trends and a useful insight through laboratory experiments and corresponding numerical validation**; Arcelor Mittal/Nippon Steel India on 15<sup>th</sup> Sep 2022.

## Contributions to the Institute

- Department faculty representative for placement and training activities.
- PhD selection Committee, MME Department IIT Ropar (2020- till present)
- Faculty Advisor for 2021 B. Tech (2021-2025)

## Others:

## Reviewer of following journals

- Journal of alloys and compound
- Transactions of Indian Institute of Metals
- Mineral processing and extractive metallurgy review
- Materials today proceedings