



Production of Sponge Iron Using COAL

Author :	Arun Kumar Agarwal
ISBN 13 :	978-93-74546-75-8
ISBN 10 :	93-74546-75-2
E-ISBN 13 :	978-93-74546-75-8
Edition :	First
Pages :	256
Type of book :	Paperback
Year :	2026
Language :	English
Publisher :	Khanna Publishing House
M.R.P :	Rs 490.00
Categories :	Metallurgical Engineering
Condition Type :	New
Country Origin :	India

Product Description

Production of Sponge Iron Using COAL Production of Sponge Iron using Coal: Rotary Kiln, Tunnel Kiln and using Gas from Coal is a definitive technical guide that explores India's global leadership in the coal-based direct reduction of iron ore. While international markets often rely on gas-based shaft processes, this book highlights how India has pioneered and perfected the use of rotary kilns to utilize abundant, high-ash non-coking coal-resources often dismissed by foreign experts as "muck". The text provides an exhaustive analysis of the thermodynamic, kinetic, and aerodynamic principles that govern the solid-state reduction of iron oxides. The book serves as a vital bridge between theoretical research and industrial application, documenting decades of expertise from leading metallurgists. It broadens the traditional focus on rotary kilns to include emerging commercial successes in tunnel kiln technology and coal gasification-based shaft furnaces. Beyond technical specifications, the authors connect modern engineering with India's ancient metallurgical heritage, such as the storied Iron Pillar of Delhi. This work is an essential resource for metallurgical students, researchers, industry professionals, and entrepreneurs seeking to understand the economic and technical nuances of sustainable ironmaking in coal-rich regions. **Salient Features**

- **Rotary Kiln Dominance:** Detailed analysis of the rotary kiln's primary role in India, covering its versatility in processing lump hematite and its unique operational strengths and weaknesses.
- **Scientific Process Modeling:** Comprehensive chapters on mathematical modeling, CFD analysis, and reaction kinetics that allow for precise control over heat transfer and solid movement.
- **Alternative Reduction Technologies:** In-depth exploration of tunnel kilns as a viable solution for reducing magnetite and iron ore fines, filling a critical gap in traditional kiln operations.
- **Coal Gasification Insights:** Evaluation of the economic and technical feasibility of converting coal into reducing gas (CO and H) to supplement production in shaft furnaces.
- **Resource Optimization:** Strategies for utilizing high-ash Indian coal and recirculating char to enhance energy efficiency and reduce the environmental footprint of ironmaking.
- **Practical Engineering Focus:** Guidance on plant design, refractory management, and overcoming common industrial hurdles like accretion or "ring formation"



Table of Contents

Glossary

- Introduction: Why, How & from Where?
- Return of Sponge Iron Making: Rotary Kiln rules in India
- Thermodynamic Considerations: Feasibility of Reactions
- Aerodynamics Inside a Sponge Iron Rotary Kiln: An Eye Opener
- Mathematical Modelling in Rotary Kiln Sponge Iron Making Precisely Controlling the Process
- Physical Movement of solids Inside a Rotary Kiln: Tumbling of Solids and Coal Throwing/Slinging – Modeling Continued
- Requirement, Generation and Transfer of Heat in a Sponge Iron Rotary Kiln: Coal is the Key!
- Reaction Kinetics: A Lot Remains to Be Understood
- Raw Materials for Sponge Iron Making: In A Rotary Kiln, Tunnel Kiln and Shaft
- Accretion Or Ring Formation Inside a Rotary Kiln: Fusion Stalls the Process
- Process Design, Engineering and Operational Aspects of an RK-DR Plant
- Other Uses of Rotary Kiln for Reduction Purposes
- Environmental Aspects of Sponge Iron Making in Rotary Kiln
- Obtaining A Reducing Gas from Coal
- Producing Sponge Iron in a Shaft Furnace
- Producing Sponge Iron in a Tunnel Kiln
- A Comparison of the Sponge Irons Produced from Different Sources and Processes
- Re-Oxidation and Auto-Ignition Properties of Sponge Iron: How to Protect During Storage, Handling and Transportation
- Uses of Sponge Iron
- Future of Sponge Iron: Reading the Crystal Ball

Addendum



Author

Dr. Krishna Kant Prasad (born on 24th January 1945 in Bhagalpur, Bihar), after completing B.Sc. Hons. (Chem.) from Bhagalpur University, he did his B.E., M.E. and Ph.D. in Metallurgical Engineering from the Indian Institute of Science, Bangalore. After brief teaching stints at the Banaras Hindu University and MR Engineering College, Jaipur he joined R&D Division of Tata Steel, Jamshedpur in 1972. He moved to RDCIS, SAIL, Ranchi in 1981 as in-charge of R&D activities in the Sponge Iron Pilot Plant Complex and since then he was actively involved in steering R&D activities both in Sponge Iron Making and Alternate Iron Making areas. He retired from SAIL, in January 2006. Thereafter, he served as a visiting professor in the Department of Metallurgical Engineering in IT (now IIT), BHU, Varanasi, for two and then joined NITK (National Institute of Technology Karnataka) in Surathkal, initially as the Ministry of Steel Chair Professor, and then in various capacities - all equivalent to a visiting professor - for seven and a half years. Dr. Prasad has guided four Ph.D. students. He has to his credit over 130 research papers, five registered copyrights and holds two patents on sponge iron making. He has authored four books entitled Sponge Iron Making in Rotary Kiln, Chemical and Metallurgical Thermodynamics, Advances in Rotary Kiln Sponge Iron Plant and Integrated Iron- and Steelmaking. He has also edited two books - "Trends in Beneficiation and Agglomeration of Iron Ore" and 'Steel Plant Technologies: An Overview. He is life member of the Indian Institute of Metals, Electrochemical Society of India and the Computer Society of India. E-mail: kkpmpnc@gmail.com. **Professor Hem Shankar Ray** (born on 19th June 1940, Jabalpur, Madhya Pradesh) unfortunately left for his heavenly abode on 28th April 2023 just as the preparation of the manuscript started. Prof. H. S. Ray is widely regarded as one of the greatest minds of the Indian scientific community and a very well-known name in the field of Extractive Metallurgy. He obtained his B.Tech. (Hons.) in Metallurgical Engineering from the Indian Institute of Technology, Kharagpur (1962) and M.A.Sc. and Ph.D. degrees from the University of Toronto, Canada (1963, 67). He was with I.I.T. Kanpur from 1967-80 as Lecturer and Asst. Professor. In between he served as Manager/Senior Technologist - Research and Development, Pilkington Research Centre, Lathom, England (1977-1979). He then served as Professor of Metallurgical Engineering (1980-1990) and Dean of Students Affairs (1988-90) at the Indian Institute of Technology, Kharagpur. Prof. Ray served the Regional Research Laboratory, Bhubaneswar (now IMMTRD) as Director from 1990-2000 (two terms). On retirement he served as an Emeritus Scientist at the Central Glass and Ceramic Research Institute, Calcutta. He holds several patents including 2 U.S. patents to his credit. His areas of interest included thermal analysis, kinetics, extractive metallurgy, energy and R&D administration. He guided about 40 Ph.D. students and 20 M.Tech. students for their thesis work. He has published about 500 papers in reviewed journals and conference proceedings and over 26 books. He also edited 15 Conference proceedings and written about 50 technical reports. He also wrote numerous other non-technical articles, editorials, etc. Prof. Ray received several awards in recognition of his work and these include the National Metallurgists Day Award, G.D. Birla Award and two Kamani Gold Medals of the Indian Institute of Metals. He received the Distinguished Alumni award from IIT Kharagpur, which, interestingly, he shared that year with the Google CEO,



Khanna Publishing House

4C/4344, Ansari Road, Daryaganj, New Delhi-110002

Email: contact@khannabooks.com | Tel: 011-2324 44 47 - 48 | Mobile: + +91-99109 09320