

## <<有色冶金炉窑仿真与优化>>

### 图书基本信息

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### 前言

Due to the tremendous variety of nonferrous metals and their processes of extraction, the furnaces and kilns used for nonferrous metallurgical engineering ( FKNME ) vary largely in terms of structure, heating mechanism and functionality .The incomplete statistics show that currently there are over one hundred types of FKNME around the world. Despite this wide variety, however, these FKNME share a few characteristics in common: first of all, most FKNME are heavilyenergyconsuming, with low energy utilization effectiveness usually ranging from15% to 50%. The energy needed to extract nonferrous metals is approximated 2:5to 25 times that for ferrous metals. China is facing an even bigger challenge in this area. The mean energy consumption rates in China are much higher than that of the most advanced indices in the world. Secondly, FKNME usually generate moretoxic emissions such as sulfur dioxide, fluoride, chloride, arsenide,etc. Thirdly, theperformance of the FKNME is often influenced by many factors, the effects ofwhich are usually non-linear and considerable hysteresis can be found. These difficulties account for the relatively lower process controllability and lowerautomatization level of the FKNME. It is clear, from the three common characteristics described above, that the FKNME practices are challenging for the industry and therefore deserve mores trenuous investigation. For the purpose of effectively upgrading FKNME technologies and improving performance, it is imperative that the following is suesbe addressed and resolved. Firstly, the output should be maximized by improving the efficiencies of both thermal and production processes. Secondly, the quality control of the production should be more stringent so as to minimize contaminations in the products and the losses of the useful elements. Thirdly, a longer service life of the FKNME can be achieved by reducing the consumption of the refractory and other construction materials. The fourth and the fifth issues are respectively the reduction of the energy consumption and the pollution emissions. The last two issues are highly correlated.

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### 内容概要

《有色冶金炉窑仿真与优化(全英文国际版)》内容简介：Simulation and Optimization of Furnaces and Kilns for Nonferrous Metallurgical Engineering is based on advanced theories and research methods for fluid flow, mass and heat transfer, and fuel combustion. It introduces a hologram simulation and optimization methods for fluid field, temperature field, concentration field, and electro-magnetic field in various kinds of furnaces and kilns. Practical examples and a detailed introduction to methods for simulation and optimization of complex systems are included as well. These new methods have brought significant economic benefits to the industries involved. The book is intended for researchers and technical experts in metallurgical engineering, materials engineering, power and thermal energy engineering, chemical engineering, and mechanical engineering. Chi Mei, Jiemin Zhou, Xiaoqi Peng, Naijun Zhou and Ping Zhou are all professors at School of Energy Science and Engineering, Central South University, Changsha, Hunan Province, China.

## 书籍目录

1 Introduction1.1 Classification of the Furnaces and Kilns for Nonferrous Metallurgical Engineering (FKNME)1.2 The Thermophysical Processes and Thermal Systems of the FKNME1.3 A Review of the Methodologies for Designs and Investigations of FKNME 1.3.1 Methodologies for design and investigation of FKNME1.3.2 The characteristics of the MHSO method1.4 Models and Modeling for the FKNME1.4.1 Models for the modern FKNME1.4.2 The modeling processReferences2 Modeling of the Thermophysical Processes in FKNME2.1 Modeling of the Fluid Flow in the FKNME2.1.1 Introduction2.1.2 The Reynolds-averaging and the Favre-averaging methods2.1.3 Turbulence models2.1.4 Low Reynolds number k-e models2.1.5 Re-Normalization Group (RNG) k-e models2.1.6 Reynolds stresses model(RSM)2.2 The Modeling of the Heat Transfer in FKNME2.2.1 Characteristics of heat transfer inside furnaces2.2.2 Zone method2.2.3 Monte Carlo method2.2.4 Discrete transfer radiation model2.3 The Simulation of Combustion and Concentration Field2.3.1 Basic equations of fluid dynamics including chemical reactions2.3.2 Gaseous combustion models2.3.3 Droplet and particle combustion models2.3.4 NO<sub>x</sub> models2.4 Simulation of Magnetic Field2.4.1 Physical models2.4.2 Mathematical model of current field2.4.3 Mathematical models of magnetic field in conductive elements..2.4.4 Magnetic field models of ferromagnetic elements2.4.5 Three-dimensional mathematical model of magnetic field2.5 Simulation on Melt Flow and Velocity Distribution in Smelting Furnaces2.5.1 Mathematical model for the melt flow in smelting furnace2.5.2 Electromagnetic flow2.5.3 The melt motion resulting from jet-flowReferences3 Hologram Simulation of the FKNME3.1 Concept and Characteristics of Hologram Simulation3.2 Mathematical Models of Hologram Simulation3.3 Applying Hologram Simulation to Multi-field Coupling3.3.1 Classification of multi-field coupling3.3.2 An example of intra-phase three-field coupling3.3.3 An example of four-field coupling3.4 Solutions of Hologram Simulation ModelsReferences4 Thermal Engineering Processes Simulation Based on Artificial Intelligence4.1 Characteristics of Thermal Engineering Processes in Nonferrous Metallurgical Furnaces4.2 Introduction to Artificial Intelligence Methods4.2.1 Expert system4.2.2 Fuzzy simulation4.2.3 Artificial neural network4.3 Modeling Based on Intelligent Fuzzy Analysis4.3.1 Intelligent fuzzy self-adaptive modeling of multi-variable system4.3.2 Example: fuzzy adaptive decision-making model for nickel matte smelting process in submerged arc furnace4.4 Modeling Based on Fuzzy Neural Network Analysis4.4.1 Fuzzy neural network adaptive modeling methods of multi-variable system4.4.2 Example: fuzzy neural network adaptive decision-making model for production process in slag cleaning furnaceReferences5 Hologram Simulation of Aluminum Reduction Cells5.1 Introduction5.2 Computation and Analysis of the Electric Field and Magnetic Field5.2.1 Computation model of electric current in the bus bar5.2.2 Computational model of electric current in the anode5.2.3 Computation and analysis of electric field in the melt5.2.4 Computation and analysis of electric field in the cathode5.2.5 Computation and analysis of the magnetic field5.3 Computation and Analysis of the Melt Flow Field5.3.1 Electromagnetic force in the melt5.3.2 Analysis of the molten aluminum movement5.3.3 Analysis of the electrolyte movement5.3.4 Computation of the melt velocity field5.4 Analysis of Thermal Field in Aluminum Reduction Cells5.4.1 Control equations and boundary conditions5.4.2 Calculation methods5.5 Dynamic Simulation for Aluminum Reduction Cells5.5.1 Factors influencing operation conditions and principle of the dynamic simulation5.5.2 Models and algorithm5.5.3 Technical scheme of the dynamic simulation and function of the software system5.6 Model of Current Efficiency of Aluminum Reduction Cells5.6.1 Factors influencing current efficiency and its measurements5.6.2 Models of the current efficiencyReferences6 Simulation and Optimization of Electric Smelting Furnace6.1 Introduction6.2 Sintering Process Model of Self-baking Electrode in Electric Smelting Furnace6.2.1 Electric and thermal analytical model of the electrode6.2.2 Simulation software6.2.3 Analysis of the computational result and the baking process6.2.4 Optimization of self-baking electrode configuration and operation regime6.3 Modeling of Bath Flow in Electric Smelting Furnace6.3.1 Mathematical model for velocity field of bath6.3.2 The forces acting on molten slag6.3.3 Solution algorithms and characters6.4 Heat Transfer in the Molten Pool and Temperature Field Model of the Electric Smelting Furnace6.4.1 Mathematical model of the temperature field in the molten pool6.4.2 Simulation software6.4.3 Calculation results and verification 6.4.4

<<有色冶金炉窑仿真与优化>>

Evaluation and optimization of the furnace design and operation  
References  
7 Coupling Simulation of Four-field in Flame Furnace  
7.1 Introduction  
7.2 Simulation and Optimization of Combustion Chamber of Tower-Type Zinc Distillation Furnace  
7.2.1 Physical model  
7.2.2 Mathematical model  
7.2.3 Boundary conditions  
7.2.4 Simulation of the combustion chamber prior to structure optimization  
7.2.5 Structure simulation and optimization of combustion chamber  
7.3 Four-field Coupling Simulation and Intensification of Smelting in Reaction Shaft of Flash Furnace  
7.3.1 Mechanism of flash smelting process  
particle fluctuating collision model  
7.3.2 Physical model  
7.3.3 Mathematical model——coupling computation of particle and gas phases  
7.3.4 Simulation results and discussion  
7.3.5 Enhancement of smelting intensity in flash furnace  
References  
8 Modeling of Dilute and Dense Phase in Generalized Fluidization  
8.1 Introduction  
8.2 "Particle Size Distribution Models  
8.2.1 Normal distribution model  
8.2.2 Logarithmic probability distribution model  
8.2.3 Weibull probability distribution function.....  
9 Multiple Modeling of Single-ended Radiant Tubes  
10 Multi-objective Systematic Optimization of FKNM  
Index

## &lt;&lt;有色冶金炉窑仿真与优化&gt;&gt;

## 章节摘录

插图：AI means the abilities of some machines to execute some complex functions concerned on human intelligencesuch as judgment and decision-making, image identifying, learning and understanding etc. AI, which based on a symbol system and information processing, is an important branch of computer science. The main research fields include: natural language processing, logic deduction and automated theorem proving, intelligent data retrieval system, robot and its visual system, automated programming, expert system and so on. In 1965, Chinese American scientist K.S. Fu first proposed applying heuristicrules of AI theory to learning control systems ( Fu, 1965 ). In 1971, after studying the relationship between intelligence technology and learning control, he put forward the concept of intelligent control ( Fu, 1971 ), and pointed out that intelligent control is the cross of control theory and AI technology ( that is the "binary elements theory" of intelligent control ), which combines AI theory and technology with control theory and technology. In unknown environment, humanintelligence is simulated so that system control can be realized effectively. In 1977, after proposing that intelligent control is the cross of control theory, operation research and AI technology ( that is the "three elements theory" of intelligent control ), G.N. Saridis proposed hierarchically intelligent control ( Saridis, 1977 ), namely, the structure of intelligent control can be divided in tothree hierarchies from top to bottom: organization, coordination and control, the precision of control increases in turn, while intelligence degree decreases in turn. Since then, the research and application of intelligent control attracted more and more attention from many countries. Especially, fuzzy logic control, neural network control and expert control, as three typical intelligent control methods, have absolute superiority to traditional control methods, and can control effectively complex systems with the characteristics of nonlinear, multiple variables, long time delay, strong coupling and so on, therefore, they have been widely applied in engineering. At present, combining the abilities such as parallel learning, remembering and associating of neural network with fuzzy reasoning technology to form a self learning fuzzy controller ( Zhang and Li, 1995 ), combining expert system theory and technology with fuzzy logic technology to form an expert fuzzy control and decision making system have been become the important trends in the field of intelligent decision making and control ( Wang, 1994 ).

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