

《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 heavily energy consuming, with low energy utilization effectiveness usually ranging from 15% to 50%. The energy needed to extract nonferrous metals is approximated 2.5 to 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 more toxic emissions such as sulfur dioxide, fluoride, chloride, arsenide, etc. Thirdly, the performance of the FKNME is often influenced by many factors, the effects of which are usually non-linear and considerable hysteresis can be found. These difficulties account for the relatively lower process controllability and lower automatization 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 more strenuous investigation. For the purpose of effectively upgrading FKNME technologies and improving performance, it is imperative that the following issues be 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.

1	Introduction	1.1	Classification of the Furnaces and Kilns for Nonferrous Metallurgical Engineering (FKNME)	1.2	The Thermophysical Processes and Thermal Systems of the FKNME	1.3	A Review of the Methodologies for Designs and Investigations of FKNME	1.3.1	Methodologies for design and investigation of FKNME	1.3.2	The characteristics of the MHSO method	1.4	Models and Modeling for the FKNME	1.4.1	Models for the modern FKNME	1.4.2	The modeling process	References	2	Modeling of the Thermophysical Processes in FKNME	2.1	Modeling of the Fluid Flow in the FKNME	2.1.1	Introduction	2.1.2	The Reynolds-averaging and the Favre-averaging methods	2.1.3	Turbulence models	2.1.4	Low Reynolds number k-e models	2.1.5	Re-Normalization Group (RNG) k-e models	2.1.6	Reynolds stresses model(RSM)	2.2	The Modeling of the Heat Transfer in FKNME	2.2.1	Characteristics of heat transfer inside furnaces	2.2.2	Zone method	2.2.3	Monte Carlo method	2.2.4	Discrete transfer radiation model	2.3	The Simulation of Combustion and Concentration Field	2.3.1	Basic equations of fluid dynamics including chemical reactions	2.3.2	Gaseous combustion models	2.3.3	Droplet and particle combustion models	2.3.4	NO _x models	2.4	Simulation of Magnetic Field	2.4.1	Physical models	2.4.2	Mathematical model of current field	2.4.3	Mathematical models of magnetic field in conductive elements.	2.4.4	Magnetic field models of ferromagnetic elements	2.4.5	Three-dimensional mathematical model of magnetic field	2.5	Simulation on Melt Flow and Velocity Distribution in Smelting Furnaces	2.5.1	Mathematical model for the melt flow in smelting furnace	2.5.2	Electromagnetic flow	2.5.3	The melt motion resulting from jet-flow	References	3	Hologram Simulation of the FKNME	3.1	Concept and Characteristics of Hologram Simulation	3.2	Mathematical Models of Hologram Simulation	3.3	Applying Hologram Simulation to Multi-field Coupling	3.3.1	Classification of multi-field coupling	3.3.2	An example of intra-phase three-field coupling	3.3.3	An example of four-field coupling	3.4	Solutions of Hologram Simulation Models	References	4	Thermal Engineering Processes Simulation Based on Artificial Intelligence	4.1	Characteristics of Thermal Engineering Processes in Nonferrous Metallurgical Furnaces	4.2	Introduction to Artificial Intelligence Methods	4.2.1	Expert system	4.2.2	Fuzzy simulation	4.2.3	Artificial neural network	4.3	Modeling Based on Intelligent Fuzzy Analysis	4.3.1	Intelligent fuzzy self-adaptive modeling of multi-variable system	4.3.2	Example: fuzzy adaptive decision-making model for nickel matte smelting process in submerged arc furnace	4.4	Modeling Based on Fuzzy Neural Network Analysis	4.4.1	Fuzzy neural network adaptive modeling methods of multi-variable system	4.4.2	Example: fuzzy neural network adaptive decision-making model for production process in slag cleaning furnace	References	5	Hologram Simulation of Aluminum Reduction Cells	5.1	Introduction	5.2	Computation and Analysis of the Electric Field and Magnetic Field	5.2.1	Computation model of electric current in the bus bar	5.2.2	Computational model of electric current in the anode	5.2.3	Computation and analysis of electric field in the melt	5.2.4	Computation and analysis of electric field in the cathode	5.2.5	Computation and analysis of the magnetic field	5.3	Computation and Analysis of the Melt Flow Field	5.3.1	Electromagnetic force in the melt	5.3.2	Analysis of the molten aluminum movement	5.3.3	Analysis of the electrolyte movement	5.3.4	Computation of the melt velocity field	5.4	Analysis of Thermal Field in Aluminum Reduction Cells	5.4.1	Control equations and boundary conditions	5.4.2	Calculation methods	5.5	Dynamic Simulation for Aluminum Reduction Cells	5.5.1	Factors influencing operation conditions and principle of the dynamic simulation	5.5.2	Models and algorithm	5.5.3	Technical scheme of the dynamic simulation and function of the software system	5.6	Model of Current Efficiency of Aluminum Reduction Cells	5.6.1	Factors influencing current efficiency and its measurements	5.6.2	Models of the current efficiency	References	6	Simulation and Optimization of Electric Smelting Furnace	6.1	Introduction	6.2	Sintering Process Model of Self-baking Electrode in Electric Smelting Furnace	6.2.1	Electric and thermal analytical model of the electrode	6.2.2	Simulation software	6.2.3	Analysis of the computational result and the baking process	6.2.4	Optimization of self-baking electrode configuration and operation regime	6.3	Modeling of Bath Flow in Electric Smelting Furnace	6.3.1	Mathematical model for velocity field of bath	6.3.2	The forces acting on molten slag	6.3.3	Solution algorithms and characters	6.4	Heat Transfer in the Molten Pool and Temperature Field Model of the Electric Smelting Furnace	6.4.1	Mathematical model of the temperature field in the molten pool	6.4.2	Simulation software	6.4.3	Calculation results and verification	6.4.4	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
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《有色冶金炉窑仿真与优化》

Distillation Furnace7.2.1 Physical model7.2.2 Mathematical model7.2.3 Boundary conditions7.2.4 Simulation of the combustion chamber prior to structure optimization7.2.5 Structure simulation and optimization of combustion chamber7.3 Four-field Coupling Simulation and Intensification of Smelting in Reaction Shaft of Flash Furnace7.3.1 Mechanism of flash smelting processparticle fluctuating collision model7.3.2 Physicalmodel7.3.3 Mathematical model——coupling computation of particle and gas phases7.3.4 Simulation results and discussion7.3.5 Enhancement of smelting intensity in flash furnaceReferences8 Modeling of Dilute and Dense Phase in Generalized Fluidization8. 1 Introduction 8.2 "Particle Size Distribution Models8.2.1 Normal distribution model8.2.2 Logarithmic probability distribution model8.2.3 Weibull probability distribution function.....9 Multiple Modeling of Single-ended Radiant Tubes10 Multi-objective Sytematic Optimization of FKNMEIndex

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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