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*Superconductors in the Power Grid* - C. Rey  
2015-04-20

Superconductors offer high throughput with low electric losses and have the potential to transform the electric power grid. Transmission networks incorporating cables of this type could, for example, deliver more power and enable substantial energy savings. Superconductors in the Power Grid: Materials and Applications provides an overview of superconductors and their applications in power grids. Sections address the design and engineering of cable systems and fault current limiters and other emerging applications for superconductors in the power grid, as well as case studies of industrial applications of superconductors in the power grid. Expert editor from highly respected US government-funded research centre Unique focus on superconductors in the power grid  
Comprehensive coverage  
The 2011 Fukushima Nuclear Power Plant Accident - Yotaro Hatamura 2014-11-28

In March 2011 the Fukushima nuclear power plant (NPP) in Japan was hit by an earthquake and subsequent tsunami which resulted in the release of significant amounts of radioactive material. The incident led to the suspension of nuclear programmes by a number of countries. This book provides a definitive account of the accident. Outlines the main sequence of events of the 2011 Fukushima nuclear power plant accident, considers the responses of central and local government, and evaluates the response of the plant owner TEPCO. Describes and assesses the effectiveness of the evacuation process and subsequent decontamination of the site and local area. Offers recommendations for improving the safe design and operation of nuclear power plants and considers the future of the Fukushima plant and nuclear power generation in Japan.

**Nuclear Decommissioning** - Michele Laraia  
2012-02-21

Once a nuclear installation has reached the end

of its safe and economical operational lifetime, the need for its decommissioning arises. Different strategies can be employed for nuclear decommissioning, based on the evaluation of particular hazards and their attendant risks, as well as on the analysis of costs of clean-up and waste management. This allows for decommissioning either soon after permanent shutdown, or perhaps a long time later, the latter course allowing for radioactivity levels to drop in any activated or contaminated components. It is crucial for clear processes and best practices to be applied in decommissioning such installations and sites, particular where any significant health and environmental risks exist. This book critically reviews the nuclear decommissioning processes and technologies applicable to nuclear power plants and other civilian nuclear facilities. Part one focuses on the fundamental planning issues in starting a nuclear decommissioning process, from principles and safety regulations, to financing

and project management. Part two covers the execution phase of nuclear decommissioning projects, detailing processes and technologies such as dismantling, decontamination, and radioactive waste management, as well as environmental remediation, site clearance and reuse. Finally, part three details international experience in the decommissioning of nuclear applications, including the main nuclear reactor types and nuclear fuel cycle facilities, as well as small nuclear facilities and legacy nuclear waste sites. Critically reviews nuclear decommissioning processes and technologies applicable to nuclear power plants and other civilian nuclear facilities Discusses the fundamental planning issues in starting a nuclear decommissioning process Considers the execution phase of nuclear decommissioning projects, including dismantling, decontamination, and radioactive waste management, as well as environmental remediation, site clearance and reuse

*Waste to Energy Conversion Technology* - Naomi B Klinghoffer 2013-05-15

Increasing global consumerism and population has led to an increase in the levels of waste produced. Waste to energy (WTE) conversion technologies can be employed to convert residual wastes into clean energy, rather than sending these wastes directly to landfill. Waste to energy conversion technology explores the systems, technology and impacts of waste to energy conversion. Part one provides an introduction to WTE conversion and reviews the waste hierarchy and WTE systems options along with the corresponding environmental, regulatory and techno-economic issues facing this technology. Part two goes on to explore further specific aspects of WTE systems, engineering and technology and includes chapters on municipal solid waste (MSW) combustion plants and WTE systems for district heating. Finally, part three highlights pollution control systems for waste to energy

technologies. Waste to energy conversion technology is a standard reference book for plant managers, building engineers and consultants requiring an understanding of WTE technologies, and researchers, scientists and academics interested in the field. Reviews the waste hierarchy and waste to energy systems options along with the environmental and social impact of WTE conversion plants Explores the engineering and technology behind WTE systems including considerations of municipal solid waste (MSW) its treatment, combustion and gasification Considers pollution control systems for WTE technologies including the transformation of waste combustion facilities from major polluters to pollution sinks

[Compendium of Hydrogen Energy](#) - Ram Gupta 2016-02-03

Compendium of Hydrogen Energy, Volume 2: Hydrogen Storage, Distribution and Infrastructure focuses on the storage and transmission of hydrogen. As many experts

believe the hydrogen economy will, at some point, replace the fossil fuel economy as the primary source of the world's energy, this book details hydrogen storage in pure form, including chapters on hydrogen liquefaction, slush production, as well as underground and pipeline storage. Other sections in the book explore physical and chemical storage, including environmentally sustainable methods of hydrogen production from water, with final chapters dedicated to hydrogen distribution and infrastructure. Covers a wide array of methods for storing hydrogen, detailing hydrogen transport and the infrastructure required for transition to the hydrogen economy Written by leading academics in the fields of sustainable energy and experts from the world of industry Part of a very comprehensive compendium which looks at the entirety of the hydrogen energy economy

Irradiation Embrittlement of Reactor Pressure Vessels (RPVs) in Nuclear Power Plants - Naoki

Soneda 2014-09-01

Reactor Pressure Vessels (RPVs) contain the fuel and therefore the reaction at the heart of nuclear power plants. They are a life-determining structural component: if they suffer serious damage, the continued operation of the plant is in jeopardy. This book critically reviews irradiation embrittlement, the main degradation mechanism affecting RPV steels, and mitigation routes for managing the RPV lifetime. Part I reviews RPV design and fabrication in different countries, with an emphasis on the materials required, their important properties, and manufacturing technologies. Part II then considers RVP embrittlement in operational nuclear power plants using different reactors. Chapters are devoted to embrittlement in light-water reactors, including WWER-type reactors and Magnox reactors. Finally, Part III presents techniques for studying embrittlement, including irradiation simulation techniques, microstructural characterisation techniques, and

probabilistic fracture mechanics. Irradiation Embrittlement of Reactor Pressure Vessels (RPVs) in Nuclear Power Plants provides a thorough review of an issue that is central to the safety of nuclear power generation. The book includes contributions from an international team of experts, and will be a useful resource for nuclear plant operators and managers, relevant regulatory and safety bodies, nuclear metallurgists and other academics in this field. Discusses reactor pressure vessel (RPV) design and the effect irradiation embrittlement can have, the main degradation mechanism affecting RPVs. Examines embrittlement processes in RPVs in different reactor types, as well as techniques for studying RPV embrittlement.

**Failure Investigation of Boiler Tubes: A Comprehensive Approach** - Paresh Haribhakti  
2018

Failures or forced shutdowns in power plants are often due to boilers, and particularly failure of boiler tubes. This comprehensive resource

deals with the subject of failure investigation of boiler tubes from basic fundamentals to practical applications. Coverage includes properties and selection of materials for boiler tubes from a metallurgical view point, damage mechanisms responsible for failure of boiler tubes, and characterization techniques employed for investigating failures of boiler tubes in thermal power plants and utility boilers of industrial/commercial/institutional (ICI) boilers. A large number of case studies based on the actual failures from the field are described, along with photographs and microstructures to allow for easy comprehension of the theory behind the failures. This book is geared to practicing engineers and for studies in the major area of power plant engineering. For non-metallurgists, a chapter has been devoted to the basics of material science, metallurgy of steels, heat treatment, and structure-property correlation. A chapter on materials for boiler tubes covers composition and application of

different grades of steels and high temperature alloys currently in use as boiler tubes and future materials to be used in supercritical, ultra-supercritical and advanced ultra-supercritical thermal power plants. A comprehensive discussion on different mechanisms of boiler tube failure is the heart of the book. Additional chapters detailing the role of advanced material characterization techniques in failure investigation and the role of water chemistry in tube failures are key contributions to the book. The authors have long-standing experience in the field of metallurgy and materials technology, failure investigation, remaining life assessment (RLA) and fitness for service (FFS) for industrial plant and equipment, including power plants. They have conducted a large number of failure investigations of boiler tubes and have recommended effective remedial measures in problem solving for power and utility boilers. Probabilistic Safety Assessment for Optimum Nuclear Power Plant Life Management (PLiM) -

Gennadij V Arkadov 2012-09-27

Probabilistic safety assessment methods are used to calculate nuclear power plant durability and resource lifetime. Successful calculation of the reliability and ageing of components is critical for forecasting safety and directing preventative maintenance, and Probabilistic safety assessment for optimum nuclear power plant life management provides a comprehensive review of the theory and application of these methods. Part one reviews probabilistic methods for predicting the reliability of equipment. Following an introduction to key terminology, concepts and definitions, formal-statistical and various physico-statistical approaches are discussed. Approaches based on the use of defect-free models are considered, along with those using binomial distribution and models based on the residual defectiveness of structural materials. The practical applications of probabilistic methods for strength reliability are subsequently explored in part two. Probabilistic

methods for increasing the reliability and safety of nuclear power plant components are investigated, as are the use of such methods for optimising non-destructive tests, hydraulic tests, technical certification and planned-preventative maintenance. Finally, the book concludes with information on the use of probabilistic methods in ensuring leak tightness of nuclear power plant steam generator heat exchanger pipes. With its distinguished authors, Probabilistic safety assessment for optimum nuclear power plant life management is a valuable reference for all nuclear plant designers, operators, nuclear safety engineers and managers, as well as academics and researchers in this field. Discusses the theory and application of probabilistic safety assessment methods used to calculate nuclear power plant (NPP) durability and lifetime Reviews probabilistic methods in their application to NPP components and ageing pipelines for the forecasting of NPP resource lifetime and safety Addresses the key areas of

probabilistic safety analysis, optimization of the operations through in-service inspection (ISI) utilising non-destructive testing, and maintenance, service and repair approaches  
**Combined Cycle Systems for Near-Zero Emission Power Generation** - Ashok D Rao  
2012-04-12

Combined cycle power plants are one of the most promising ways of improving fossil-fuel and biomass energy production. The combination of a gas and steam turbine working in tandem to produce power makes this type of plant highly efficient and allows for CO<sub>2</sub> capture and sequestration before combustion. This book provides a comprehensive review of the design, engineering and operational issues of a range of advanced combined cycle plants. After introductory chapters on basic combined cycle power plant and advanced gas turbine design, the book reviews the main types of combined cycle system. Chapters discuss the technology, efficiency and emissions performance of natural

gas-fired combined cycle (NGCC) and integrated gasification combined cycle (IGCC) as well as novel humid air cycle, oxy-combustion turbine cycle systems. The book also reviews pressurised fluidized bed combustion (PFBC), externally fired combined cycle (EFCC), hybrid fuel cell turbine (FC/GT), combined cycle and integrated solar combined cycle (ISCC) systems. The final chapter reviews techno-economic analysis of combined cycle systems. With its distinguished editor and international team of contributors, Combined cycle systems for near-zero emission power generation is a standard reference for both industry practitioners and academic researchers seeking to improve the efficiency and environmental impact of power plants. Provides a comprehensive review of the design, engineering and operational issues of a range of advanced combined cycle plants  
Introduces basic combined cycle power plant and advanced gas turbine design and reviews the main types of combined cycle systems

Discusses the technology, efficiency and emissions performance of natural gas-fired combined cycle (NGCC) systems and integrated gasification combined cycle (IGCC) systems, as well as novel humid air cycle systems and oxy-combustion turbine cycle systems

**Power Plant Life Management and Performance Improvement** - John E Oakey  
2011-09-28

Coal- and gas-based power plants currently supply the largest proportion of the world's power generation capacity, and are required to operate to increasingly stringent environmental standards. Higher temperature combustion is therefore being adopted to improve plant efficiency and to maintain net power output given the energy penalty that integration of advanced emissions control systems cause. However, such operating regimes also serve to intensify degradation mechanisms within power plant systems, potentially affecting their reliability and lifespan. Power plant life

management and performance improvement critically reviews the fundamental degradation mechanisms that affect conventional power plant systems and components, as well as examining the operation and maintenance approaches and advanced plant rejuvenation and retrofit options that the industry are applying to ensure overall plant performance improvement and life management. Part one initially reviews plant operation issues, including fuel flexibility, condition monitoring and performance assessment. Parts two, three and four focus on coal boiler plant, gas turbine plant, and steam boiler and turbine plant respectively, reviewing environmental degradation mechanisms affecting plant components and their mitigation via advances in materials selection and life management approaches, such as repair, refurbishment and upgrade. Finally, part five reviews issues relevant to the performance management and improvement of advanced heat exchangers and power plant welds. With its

distinguished editor and international team of contributors, Power plant life management and performance improvement is an essential reference for power plant operators, industrial engineers and metallurgists, and researchers interested in this important field. Provides an overview of the improvements to plant efficiency in coal- and gas-based power plants Critically reviews the fundamental degradation mechanisms that affect conventional power plant systems and components, noting mitigation routes alongside monitoring and assessment methods Addresses plant operation issues including fuel flexibility, condition monitoring and performance assessment

### **Structural Materials for Generation IV**

**Nuclear Reactors** - Pascal Yvon 2016-08-27

Operating at a high level of fuel efficiency, safety, proliferation-resistance, sustainability and cost, generation IV nuclear reactors promise enhanced features to an energy resource which is already seen as an outstanding source of

reliable base load power. The performance and reliability of materials when subjected to the higher neutron doses and extremely corrosive higher temperature environments that will be found in generation IV nuclear reactors are essential areas of study, as key considerations for the successful development of generation IV reactors are suitable structural materials for both in-core and out-of-core applications. *Structural Materials for Generation IV Nuclear Reactors* explores the current state-of-the-art in these areas. Part One reviews the materials, requirements and challenges in generation IV systems. Part Two presents the core materials with chapters on irradiation resistant austenitic steels, ODS/FM steels and refractory metals amongst others. Part Three looks at out-of-core materials. *Structural Materials for Generation IV Nuclear Reactors* is an essential reference text for professional scientists, engineers and postgraduate researchers involved in the development of generation IV nuclear reactors.

Introduces the higher neutron doses and extremely corrosive higher temperature environments that will be found in generation IV nuclear reactors and implications for structural materials. Contains chapters on the key core and out-of-core materials, from steels to advanced micro-laminates. Written by an expert in that particular area.

*Organic Rankine Cycle (ORC) Power Systems* -  
Ennio Macchi 2016-08-24

*Organic Rankine Cycle (ORC) Power Systems: Technologies and Applications* provides a systematic and detailed description of organic Rankine cycle technologies and the way they are increasingly of interest for cost-effective sustainable energy generation. Popular applications include cogeneration from biomass and electricity generation from geothermal reservoirs and concentrating solar power installations, as well as waste heat recovery from gas turbines, internal combustion engines and medium- and low-temperature industrial

processes. With hundreds of ORC power systems already in operation and the market growing at a fast pace, this is an active and engaging area of scientific research and technical development. The book is structured in three main parts: (i) Introduction to ORC Power Systems, Design and Optimization, (ii) ORC Plant Components, and (iii) Fields of Application. Provides a thorough introduction to ORC power systems Contains detailed chapters on ORC plant components Includes a section focusing on ORC design and optimization Reviews key applications of ORC technologies, including cogeneration from biomass, electricity generation from geothermal reservoirs and concentrating solar power installations, waste heat recovery from gas turbines, internal combustion engines and medium- and low-temperature industrial processes Various chapters are authored by well-known specialists from Academia and ORC manufacturers  
*Advances in Clean Hydrocarbon Fuel Processing*

- M. Rashid Khan 2011-09-23  
Conventional coal, oil and gas resources used worldwide for power production and transportation are limited and unsustainable. Research and development into clean, alternative hydrocarbon fuels is therefore aimed at improving fuel security through exploring new feedstock conversion techniques, improving production efficiency and reducing environmental impacts. Advances in clean hydrocarbon fuel processing provides a comprehensive and systematic reference on the range of alternative conversion processes and technologies. Following introductory overviews of the feedstocks, environmental issues and life cycle assessment for alternative hydrocarbon fuel processing, sections go on to review solid, liquid and gaseous fuel conversion. Solid fuel coverage includes reviews of liquefaction, gasification, pyrolysis and biomass catalysis. Liquid fuel coverage includes reviews of sulfur removal, partial oxidation and hydroconversion.

Gaseous fuel coverage includes reviews of Fischer-Tropsch synthesis, methanol and dimethyl ether production, water-gas shift technology and natural gas hydrate conversion. The final section examines environmental degradation issues in fuel processing plants as well as automation, advanced process control and process modelling techniques for plant optimisation. Written by an international team of expert contributors, *Advances in clean hydrocarbon fuel processing* provides a valuable reference for fuel processing engineers, industrial petrochemists and energy professionals, as well as for researchers and academics in this field. A comprehensive reference on the range of alternative conversion processes and technologies. Provides an overview of the feedstocks, environmental issues and life cycle assessments for alternative hydrocarbon fuel processing, including a review of the key issues in solid, liquid and gaseous fuel conversion. Examines automation, advanced

process control and process modelling techniques for plant optimisation

### **Advances in Thermal Energy Storage Systems** - Luisa F. Cabeza 2014-10-31

Thermal energy storage (TES) technologies store thermal energy (both heat and cold) for later use as required, rather than at the time of production. They are therefore important counterparts to various intermittent renewable energy generation methods and also provide a way of valorising waste process heat and reducing the energy demand of buildings. This book provides an authoritative overview of this key area. Part one reviews sensible heat storage technologies. Part two covers latent and thermochemical heat storage respectively. The final section addresses applications in heating and energy systems. Reviews sensible heat storage technologies, including the use of water, molten salts, concrete and boreholes. Describes latent heat storage systems and thermochemical heat storage. Includes information on the

monitoring and control of thermal energy storage systems, and considers their applications in residential buildings, power plants and industry

*Alternative Fuels and Advanced Vehicle Technologies for Improved Environmental Performance* - Richard Folkson 2022-07-29

Alternative Fuels and Advanced Vehicle Technologies for Improved Environmental Performance: Towards Zero Carbon Transportation, Second Edition provides a comprehensive view of key developments in advanced fuels and vehicle technologies to improve the energy efficiency and environmental impact of the automotive sector. Sections consider the role of alternative fuels such as electricity, alcohol and hydrogen fuel cells, as well as advanced additives and oils in environmentally sustainable transport. Other topics explored include methods of revising engine and vehicle design to improve environmental performance and fuel economy

and developments in electric and hybrid vehicle technologies. This reference will provide professionals, engineers and researchers of alternative fuels with an understanding of the latest clean technologies which will help them to advance the field. Those working in environmental and mechanical engineering will benefit from the detailed analysis of the technologies covered, as will fuel suppliers and energy producers seeking to improve the efficiency, sustainability and accessibility of their work. Provides a fully updated reference with significant technological advances and developments in the sector Presents analyses on the latest advances in electronic systems for emissions control, autonomous systems, artificial intelligence and legislative requirements Includes a strong focus on updated climate change predictions and consequences, helping the reader work towards ambitious 2050 climate change goals for the automotive industry  
**Ultra-Supercritical Coal Power Plants -**

Dongke Zhang FTSE 2013-08-31

The continued use of coal as a means of generating electricity and an increasing demand for cleaner, more efficient energy production has led to advances in power plant technology.

Ultra-supercritical coal power plants reviews the engineering, operation, materials and performance of ultra-supercritical coal power plants. Following a chapter introducing advanced and ultra-supercritical coal power plants, part one goes on to explore the operating environments, materials and engineering of ultra-supercritical coal power plants. Chapters discuss the impacts of steam conditions on plant materials and operation, fuel considerations and burner design, and materials and design for boilers working under supercritical steam conditions. Chapters in part two focus on improving ultra-supercritical coal power plant performance and operability. Ash fouling, deposition and slagging in ultra-supercritical coal power plants are highlighted along with

pollution control measures and the estimation, management and extension of the life of ultra-supercritical power plants. Further chapters provide an economic and engineering analysis of a 700°C advanced ultra-supercritical pulverised coal power plant and discuss CO<sub>2</sub> capture-ready ultra-supercritical coal power plants. Ultra-supercritical coal power plants is a comprehensive technical reference for power plant operators and engineers, high-temperature materials scientists, professionals in the power industry who require an understanding of ultra-supercritical coal power plants and researchers and academics interested in the field. Provides a comprehensive reference on the developments, materials, design and operation of ultra-supercritical power plant Considers the degradation issues affecting this type of plant, as well as emissions control and CO<sub>2</sub> capture technology; improved plant controls critical to improved operation and environmental performance Contains operational assessments

for plant safety, plant life management, and plant economics

*Compendium of Hydrogen Energy* - Velu Subramani 2015-05-23

Compendium of Hydrogen Energy: Hydrogen Production and Purification, the first text in a four-volume series, focuses on the production of hydrogen. As many experts believe that the hydrogen economy will eventually replace the fossil fuel economy as our primary source of energy, the text provides a timely discussion on this interesting topic. The text details the methods of hydrogen production using fossil fuels, also exploring sustainable extraction methods of hydrogen production from water and hydrogen purification processes. Provides a comprehensive understanding of the current methods used in the production of hydrogen. Discusses the hydrogen economy and its potential to replace fossil fuels as our primary source of energy. Details the methods of hydrogen production using fossil fuels, also

exploring sustainable extraction methods of hydrogen production from water and hydrogen purification processes

**Compendium of Hydrogen Energy** - Michael Ball 2015-08-28

Compendium of Hydrogen Energy Volume 4: Hydrogen Use, Safety and the Hydrogen Economy focuses on the uses of hydrogen. As many experts believe the hydrogen economy will, at some point, replace the fossil fuel economy as the primary source of the world's energy, this book investigates the uses of this energy, from transport, to stationary and portable applications, with final sections discussing the difficulties and possibilities of the widespread adoption of the hydrogen economy. Written by both leading academics in the fields of sustainable energy and experts from the world of industry. Part of a very comprehensive compendium which across four volumes looks at the entirety of the hydrogen energy economy. Covers a wide array of hydrogen uses, and

details safety tactics, hydrogen applications in transport, and the hydrogen economy as a whole  
Small Modular Reactors - Daniel T Ingersoll  
2015-11-20

There is currently significant interest in the development of small modular reactors (SMRs) for the generation of both electricity and process heat. SMRs offer potential benefits in terms of better affordability and enhanced safety, and can also be sited more flexibly than traditional nuclear plants. *Small Modular Reactors: Nuclear Power Fad or Future?* reviews SMR features, promises, and problems, also discussing what lies ahead for reactors of this type. The book is organized into three major parts with the first part focused on the role of energy, especially nuclear energy, for global development. It also provides a brief history of SMRs. The second major part presents basic nuclear power plant terminology and then discusses in depth the attributes of SMRs that distinguish them from traditional nuclear plants. The third and final

major section discusses the current interest in SMRs from a customer's perspective and delineates several remaining hurdles that must be addressed to achieve wide-spread SMR deployment. Provides decision-makers in governments, business, and research with the needed background on small nuclear power and an overview of the current situation Presents a balanced discussion of the many advantages of SMRs and the challenges they face Written by a highly respected expert in the nuclear industry  
**Coal Power Plant Materials and Life Assessment** - A. Shibli 2014-07-24

Due to their continuing role in electricity generation, it is important that coal power plants operate as efficiently and cleanly as possible. *Coal Power Plant Materials and Life Assessment* reviews the materials used in coal plants, and how they can be assessed and managed to optimize plant operation. Part I considers the structural alloys used in coal plants. Part II then reviews performance modelling and life

assessment techniques, explains the inspection and life-management approaches that can be adopted to optimize long term plant operation, and considers the technical and economic issues involved in meeting variable energy demands. Summarizes key research on coal-fired power plant materials, their behavior under operational loads, and approaches to life assessment and defect management Details the range of structural alloys used in coal power plants, and the life assessment techniques applicable to defect-free components under operational loads Reviews the life assessment techniques applicable to components containing defects and the approaches that can be adopted to optimize plant operation and new plant and component design

### **Structural Alloys for Nuclear Energy**

**Applications** - Robert Odette 2019-08-15

High-performance alloys that can withstand operation in hazardous nuclear environments are critical to presentday in-service reactor

support and maintenance and are foundational for reactor concepts of the future. With commercial nuclear energy vendors and operators facing the retirement of staff during the coming decades, much of the scholarly knowledge of nuclear materials pursuant to appropriate, impactful, and safe usage is at risk. Led by the multi-award winning editorial team of G. Robert Odette (UCSB) and Steven J. Zinkle (UTK/ORNL) and with contributions from leaders of each alloy discipline, Structural Alloys for Nuclear Energy Applications aids the next generation of researchers and industry staff developing and maintaining steels, nickel-base alloys, zirconium alloys, and other structural alloys in nuclear energy applications. This authoritative reference is a critical acquisition for institutions and individuals seeking state-of-the-art knowledge aided by the editors' unique personal insight from decades of frontline research, engineering and management. Focuses on in-service irradiation, thermal,

mechanical, and chemical performance capabilities. Covers the use of steels and other structural alloys in current fission technology, leading edge Generation-IV fission reactors, and future fusion power reactors. Provides a critical and comprehensive review of the state-of-the-art experimental knowledge base of reactor materials, for applications ranging from engineering safety and lifetime assessments to supporting the development of advanced computational models.

**Structural Alloys for Power Plants** - Amir Shirzadi 2014-05-05

Current fleets of conventional and nuclear power plants face increasing hostile environmental conditions due to increasingly high temperature operation for improved capacity and efficiency, and the need for long term service. Additional challenges are presented by the requirement to cycle plants to meet peak-load operation. This book presents a comprehensive review of structural materials in conventional and nuclear

energy applications. Opening chapters address operational challenges and structural alloy requirements in different types of power plants. The following sections review power plant structural alloys and methods to mitigate critical materials degradation in power plants.

**Joint EPRI - 123HiMAT International Conference on Advances in High-Temperature Materials** - J. Shingledecker 2019-10-01

Proceedings from: EPRI's 9th International Conference on Advances in Materials Technology for Fossil Power Plants and the 2nd International 123HiMAT Conference on High-Temperature Materials

Fuel Flexible Energy Generation - John Oakey 2015-12-08

Fuel Flexible Energy Generation: Solid, Liquid and Gaseous Fuels provides updated information on flexible fuel energy generation, the process by which one or more fuels can be combusted in the same boiler or turbine to generate power. By

adapting or building boilers and turbines to accept multiple fuel sources, they can be co-fired with biomass and waste derived fuels, allowing a reduction in carbon output, thus providing cleaner energy. Fuel flexibility is becoming more important in a world of diminishing fossil fuel stocks. Many countries are investing in the development of more efficient fuel flexible boilers and turbines, and their use is becoming more prevalent in industry as well. This book provides comprehensive coverage of flexible fuel energy generation across all potential fuel types, and was written by a selection of experts in the field who discuss the types of fuels which can be used in fuel flexible energy generation, from solid fuels to biomass fuels, the preparation of fuels to be used in fuel flexible operations, that includes their handling and transport, and combustion and conversion technologies with chapters ranging from large-scale coal gasification to technology options and plant design issues. Focuses on fuel flexibility across

all potential fuel types Includes thorough treatment of the technology being developed to allow for fuel flexibility Written by leading experts in the field Provides an essential text for R&D managers in firms which produce boilers or turbines, those who work in the fuel industry, and academics working in engineering departments on energy generation  
Magnetic Fusion Energy - George Neilson  
2016-06-02

Magnetic Fusion Energy: From Experiments to Power Plants is a timely exploration of the field, giving readers an understanding of the experiments that brought us to the threshold of the ITER era, as well as the physics and technology research needed to take us beyond ITER to commercial fusion power plants. With the start of ITER construction, the world's magnetic fusion energy (MFE) enterprise has begun a new era. The ITER scientific and technical (S&T) basis is the result of research on many fusion plasma physics experiments over a

period of decades. Besides ITER, the scope of fusion research must be broadened to create the S&T basis for practical fusion power plants, systems that will continuously convert the energy released from a burning plasma to usable electricity, operating for years with only occasional interruptions for scheduled maintenance. Provides researchers in academia and industry with an authoritative overview of the significant fusion energy experiments. Considers the pathway towards future development of magnetic fusion energy power plants. Contains experts contributions from editors and others who are well known in the field.

Calcium and Chemical Looping Technology for Power Generation and Carbon Dioxide (CO<sub>2</sub>) Capture - Paul Fennell 2015-05-21

Calcium and Chemical Looping Technology for Power Generation and Carbon Dioxide (CO<sub>2</sub>) Capture reviews the fundamental principles, systems, oxygen carriers, and carbon dioxide

carriers relevant to chemical looping and combustion. Chapters review the market development, economics, and deployment of these systems, also providing detailed information on the variety of materials and processes that will help to shape the future of CO<sub>2</sub> capture ready power plants. Reviews the fundamental principles, systems, oxygen carriers, and carbon dioxide carriers relevant to calcium and chemical looping. Provides a lucid explanation of advanced concepts and developments in calcium and chemical looping, high pressure systems, and alternative CO<sub>2</sub> carriers. Presents information on the market development, economics, and deployment of these systems.

**Concentrating Solar Power Technology** - Keith Lovegrove 2020-11-26

This second edition of Concentrating Solar Power Technology edited by Keith Lovegrove and Wes Stein presents a fully updated comprehensive review of the latest technologies

and knowledge, from the fundamental science to systems design, development, and applications. Part one introduces the fundamental principles of CSP systems, including site selection and feasibility analysis, alongside socio-economic and environmental assessments. Part two focuses on technologies including linear Fresnel reflector technology, parabolic-trough, central tower, and parabolic dish CSP systems, and concentrating photovoltaic systems. Thermal energy storage, hybridization with fossil fuel power plants, and the long-term market potential of CSP technology are also explored. Part three goes on to discuss optimization, improvements, and applications, such as absorber materials for solar thermal receivers, design optimization through integrated techno-economic modelling, and heliostat size optimization. With its distinguished editors and international team of expert contributors, *Concentrating Solar Power Technology*, 2nd Edition is an essential guide for all those

involved or interested in the design, production, development, optimization, and application of CSP technology, including renewable energy engineers and consultants, environmental governmental departments, solar thermal equipment manufacturers, researchers, and academics. Provides a comprehensive review of concentrating solar power (CSP) technology, from the fundamental science to systems design, development and applications Reviews fundamental principles of CSP systems, including site selection and feasibility analysis and socio-economic and environmental assessments Includes an overview of the key technologies of parabolic-trough, central tower linear Fresnel reflector, and parabolic dish CSP systems, and concentrating photovoltaic systems *Structural Alloys for Power Plants* - A. Shirzadi 2014-07-30 Current fleets of conventional and nuclear power plants face increasing hostile environmental conditions due to increasingly high temperature

operation for improved capacity and efficiency, and the need for long term service. Additional challenges are presented by the requirement to cycle plants to meet peak-load operation. This book presents a comprehensive review of structural materials in conventional and nuclear energy applications. Opening chapters address operational challenges and structural alloy requirements in different types of power plants. The following sections review power plant structural alloys and methods to mitigate critical materials degradation in power plants.

### **Infrastructure and Methodologies for the Justification of Nuclear Power Programmes**

- Agustin Alonso 2012-01-19

The potential development of any nuclear power programme should include a rigorous justification process reviewing the substantial regulatory, economic and technical information necessary for implementation, given the long term commitments involved in any new nuclear power project. Infrastructure and methodologies

for the justification of nuclear power programmes reviews the fundamental issues and approaches to nuclear power justification in countries considering nuclear new build or redevelopment. Part one covers the infrastructure requirements for any new nuclear power programme, with chapters detailing the role and responsibilities of government, regulatory bodies and nuclear operator and the need for human resources and technical capability at the national level. Part two focuses on issues relevant to the justification process, including nuclear safety, radiation protection and emergency planning. Current designs and advanced reactors and radioactive waste management are also considered, along with the economic, social and environmental impacts of nuclear power development. Part three reviews the development of nuclear power programme, from nuclear power plant site selection and licensing, through construction and operation, and on to decommissioning. Finally, a series of

valuable appendices detail the UK experience of justification, nuclear safety culture and training, and the multinational design evaluation programme (MDEP). With its distinguished editor and expert team of contributors, Infrastructure and methodologies for the justification of nuclear power programmes is an essential reference for international and national stakeholders in this field, particularly governmental, non-governmental and regulatory bodies, nuclear power operators and consultants. Offers a comprehensive analysis of the infrastructure and methodologies required to justify the creation of nuclear power programmes in any country Provides coverage of the main issues and potential benefit linked to nuclear power Reviews the implementation of a nuclear power programme with particular reference to the requirements and methods involved in construction

**Reprocessing and Recycling of Spent Nuclear Fuel** - Robin Taylor 2015-04-18

Reprocessing and Recycling of Spent Nuclear Fuel presents an authoritative overview of spent fuel reprocessing, considering future prospects for advanced closed fuel cycles. Part One introduces the recycling and reprocessing of spent nuclear fuel, reviewing past and current technologies, the possible implications of Generation IV nuclear reactors, and associated safety and security issues. Parts Two and Three focus on aqueous-based reprocessing methods and pyrochemical methods, while final chapters consider the cross-cutting aspects of engineering and process chemistry and the potential for implementation of advanced closed fuel cycles in different parts of the world. Expert introduction to the recycling and reprocessing of spent nuclear fuel Detailed overview of past and current technologies, the possible implications of Generation IV nuclear reactors, and associated safety and security issues A lucid exploration of aqueous-based reprocessing methods and pyrochemical methods

## **Membranes for Clean and Renewable Power Applications** - A Gugliuzza 2014-03-31

The development and deployment of membrane technologies continues to advance thanks to innovative materials and novel engineering approaches. Membranes for clean and renewable power applications introduces the principles and concepts of membrane technology and explores the use of this technology in clean energy applications. Chapters in part one introduce the utilization of membrane technology in the production of clean and renewable power and the combining of membrane processes with renewable energy technologies. Part two focusses on membranes for biofuel production and processing including membranes and membrane reactors for the production of biodiesel and second generation biofuels. Part three discusses membranes for syngas, hydrogen and oxygen production and processing. Chapters highlight steam reforming of biofuels for the production of hydrogen-rich

gas A., perovskite membrane reactors, and environmental analysis of hydrogen-methane blends for transportation. Chapters in part four explore membranes for fuel cells including ceramic membranes for intermediate temperature solid oxide fuel cells (SOFC), microbial fuel cells, and direct bioethanol fuel cells. Finally, part five discusses membranes integrated with solar, wind energy and water-related applications including membrane technologies for solar-hydrogen production, solar-desalination plants, and the storage as methane of energy generated by wind power and other renewable sources. A final chapter introduces wastewater processing, energy conservation and energy generation. Membranes for clean and renewable power applications is a comprehensive resource for professionals and consultants in the clean and renewable energy industry, membrane and materials scientists and professionals, and academics and researchers in the field. Introduces the principles and concepts

of membrane technology and explores the use of this technology in clean energy applications

**Handbook of Small Modular Nuclear Reactors** - Mario D Carelli 2014-09-22

Small modular reactors (SMRs) are an advanced, safe type of nuclear reactor technology that are suitable for small and medium sized applications including both power and heat generation. In particular, their use as individual units or in combination to scale-up capacity offer benefits in terms of siting, installation, operation, lifecycle and economics in comparison to the development of larger nuclear plant for centralised electricity power grids. Interest has increased in the research and development of SMRs for both developing countries as well as such additional cogeneration options as industrial/chemical process heat, desalination and district heating, and hydrogen production. This book reviews key issues in their development as well as international R&D in the field. Gives an overview of small modular reactor

technology Reviews the design characteristics of integral pressurized water reactors and focuses on reactor core and fuel technologies, key reactor system components, instrumentation and control, human-system interfaces and safety Considers the economics, financing, licensing, construction methods and hybrid energy systems of small modular reactors Describes SMR development activities worldwide, and concludes with a discussion of how SMR deployment can contribute to the growth of developing countries

**Advances in Batteries for Medium and Large-Scale Energy Storage** - C Menictas 2014-12-09

As energy produced from renewable sources is increasingly integrated into the electricity grid, interest in energy storage technologies for grid stabilisation is growing. This book reviews advances in battery technologies and applications for medium and large-scale energy storage. Chapters address advances in nickel, sodium and lithium-based batteries. Other

chapters review other emerging battery technologies such as metal-air batteries and flow batteries. The final section of the book discusses design considerations and applications of batteries in remote locations and for grid-scale storage. Reviews advances in battery technologies and applications for medium and large-scale energy storage Examines battery types, including zing-based, lithium-air and vanadium redox flow batteries Analyses design issues and applications of these technologies Sustainable Energy from Salinity Gradients - Andrea Cipollina 2016-03-01

Salinity gradient energy, also known as blue energy and osmotic energy, is the energy obtainable from the difference in salt concentration between two feed solutions, typically sea water and river water. It is a large-scale renewable resource that can be harvested and converted to electricity. Efficient extraction of this energy is not straightforward, however. Sustainable Energy from Salinity Gradients

provides a comprehensive review of resources, technologies and applications in this area of fast-growing interest. Key technologies covered include pressure retarded osmosis, reverse electro dialysis and accumulator mixing. Environmental and economic aspects are also considered, together with the possible synergies between desalination and salinity gradient energy technologies. Sustainable Energy from Salinity Gradients is an essential text for R&D professionals in the energy & water industry interested in salinity gradient power and researchers in academia from post-graduate level upwards. For more than ten years the Editors have been sharing substantial research activities in the fields of renewable energy and desalination, successfully participating to a number of European Union research projects and contributing to the relevant scientific literature with more than 100 papers and 2 books on Desalination technologies and their coupling with Renewable Energy. They are

intensely working in the field of Salinity Gradient Power, carrying out research with specific focus on open-loop and closed-loop reverse electrodialysis and pressure retarded osmosis. Covers applications of pressure retarded osmosis, reverse electrodialysis, and capacitive mixing for salinity gradient power in one convenient volume Presents the environmental aspects and economics of salinity gradient energy Explores possible synergies between desalination and salinity gradient energy

### **Nuclear Fuel Cycle Science and Engineering**

- Ian Crossland 2012-09-21

The nuclear fuel cycle is characterised by the wide range of scientific disciplines and technologies it employs. The development of ever more integrated processes across the many stages of the nuclear fuel cycle therefore confronts plant manufacturers and operators with formidable challenges. Nuclear fuel cycle science and engineering describes both the key

features of the complete nuclear fuel cycle and the wealth of recent research in this important field. Part one provides an introduction to the nuclear fuel cycle. Radiological protection, security and public acceptance of nuclear technology are considered, along with the economics of nuclear power. Part two goes on to explore materials mining, enrichment, fuel element design and fabrication for the uranium and thorium nuclear fuel cycle. The impact of nuclear reactor design and operation on fuel element irradiation is the focus of part three, including water and gas-cooled reactors, along with CANDU and Generation IV designs. Finally, part four reviews spent nuclear fuel and radioactive waste management. With its distinguished editor and international team of expert contributors, Nuclear fuel cycle science and engineering provides an important review for all those involved in the design, fabrication, use and disposal of nuclear fuels as well as regulatory bodies and researchers in this field.

Provides a comprehensive and holistic review of the complete nuclear fuel cycle Reviews the issues presented by the nuclear fuel cycle, including radiological protection and security, public acceptance and economic analysis Discusses issues at the front-end of the fuel cycle, including uranium and thorium mining, enrichment and fuel design and fabrication Materials for Ultra-Supercritical and Advanced Ultra-Supercritical Power Plants - Augusto Di Gianfrancesco 2016-09-01

Materials for Ultra-Supercritical and Advanced Ultra-Supercritical Power Plants provides researchers in academia and industry with an essential overview of the stronger high-temperature materials required for key process components, such as membrane wall tubes, high-pressure steam piping and headers, superheater tubes, forged rotors, cast components, and bolting and blading for steam turbines in USC power plants. Advanced materials for future advanced ultra-supercritical

power plants, such as superalloys, new martensitic and austenitic steels, are also addressed. Chapters on international research directions complete the volume. The transition from conventional subcritical to supercritical thermal power plants greatly increased power generation efficiency. Now the introductions of the ultra-supercritical (USC) and, in the near future, advanced ultra-supercritical (A-USC) designs are further efforts to reduce fossil fuel consumption in power plants and the associated carbon dioxide emissions. The higher operating temperatures and pressures found in these new plant types, however, necessitate the use of advanced materials. Provides researchers in academia and industry with an authoritative and systematic overview of the stronger high-temperature materials required for both ultra-supercritical and advanced ultra-supercritical power plants Covers materials for critical components in ultra-supercritical power plants, such as boilers, rotors, and turbine blades

Addresses advanced materials for future advanced ultra-supercritical power plants, such as superalloys, new martensitic and austenitic steels Includes chapters on technologies for welding technologies

**Handbook of Generation IV Nuclear Reactors** - Igor Pioro 2016-06-09

Handbook of Generation IV Nuclear Reactors presents information on the current fleet of Nuclear Power Plants (NPPs) with water-cooled reactors (Generation III and III+) (96% of 430 power reactors in the world) that have relatively low thermal efficiencies (within the range of 32-36%) compared to those of modern advanced thermal power plants (combined cycle gas-fired power plants - up to 62% and supercritical pressure coal-fired power plants - up to 55%). Moreover, thermal efficiency of the current fleet of NPPs with water-cooled reactors cannot be increased significantly without completely different innovative designs, which are Generation IV reactors. Nuclear power is vital

for generating electrical energy without carbon emissions. Complete with the latest research, development, and design, and written by an international team of experts, this handbook is completely dedicated to Generation IV reactors. Presents the first comprehensive handbook dedicated entirely to generation IV nuclear reactors Reviews the latest trends and developments Complete with the latest research, development, and design information in generation IV nuclear reactors Written by an international team of experts in the field

**High Temperature Superconductors (HTS) for Energy Applications** - Ziad Melhem 2011-12-21

High temperature superconductors (HTS) offer many advantages through their application in electrical systems, including high efficiency performance and high throughput with low-electrical losses. While cryogenic cooling and precision materials manufacture is required to achieve this goal, cost reductions without

significant performance loss are being achieved through the advanced design and development of HTS wires, cables and magnets, along with improvements in manufacturing methods. This book explores the fundamental principles, design and development of HTS materials and their practical applications in energy systems. Part one describes the fundamental science, engineering and development of particular HTS components such as wires and tapes, cables, coils and magnets and discusses the cryogenics and electromagnetic modelling of HTS systems and materials. Part two reviews the types of energy applications that HTS materials are used in, including fault current limiters, power cables and energy storage, as well as their application in rotating machinery for improved electrical efficiencies, and in fusion technologies and accelerator systems where HTS magnets are becoming essential enabling technologies. With its distinguished editor and international team of expert contributors, High temperature

superconductors (HTS) for energy applications is an invaluable reference tool for anyone involved or interested in HTS materials and their application in energy systems, including materials scientists and electrical engineers, energy consultants, HTS materials manufacturers and designers, and researchers and academics in this field. Discusses fundamental issues and developments of particular HTS components Comprehensively reviews the design and development of HTS materials and then applications in energy systems Reviews the use of HTS materials and cabling transmissions, fault alignment limiters, energy storage, generators and motors, fusion and accelerator

**Geothermal Power Generation** - Ron DiPippo  
2016-05-25

Geothermal Power Generation: Developments and Innovation provides an update to the advanced energy technologies that are urgently required to meet the challenges of economic

development, climate change mitigation, and energy security. As geothermal resources are considered renewable and can be used to generate baseload electricity while producing very low levels of greenhouse gas emissions, they can play a key role in future energy needs. This book, edited by a highly respected expert, provides a comprehensive overview of the major aspects of geothermal power production. The chapters, contributed by specialists in their respective areas, cover resource discovery, resource characterization, energy conversion systems, and design and economic considerations. The final section provides a range of fascinating case studies from across the world, ranging from Larderello to Indonesia. Users will find this to be an essential text for research and development professionals and engineers in the geothermal energy industry, as well as postgraduate researchers in academia who are working on geothermal energy. Provides readers with a comprehensive and

systematic overview of geothermal power generation Presents an update to the advanced energy technologies that are urgently required to meet the challenges of economic development, climate change mitigation, and energy security Edited by a world authority in the field, with chapters contributed by experts in their particular areas Includes comprehensive case studies from across the world, ranging from Larderello to Indonesia

### **Membrane Reactors for Energy Applications and Basic Chemical Production - Angelo**

Basile 2015-02-10

Membrane Reactors for Energy Applications and Basic Chemical Production presents a discussion of the increasing interest in membrane reactors that has emerged in recent years from both the scientific and industrial communities, in particular their usage for energy applications and basic chemical production. Part One of the text investigates membrane reactors for syngas and hydrogen production, while Part Two

examines membrane reactors for other energy applications, including biodiesel and bioethanol production. The final section of the book reviews the use of membrane reactors in basic chemical production, including discussions of the use of MRs in ammonia production and the dehydrogenation of alkanes to alkenes. Provides comprehensive coverage of membrane reactors

as presented by a world-renowned team of experts Includes discussions of the use of membrane reactors in ammonia production and the dehydrogenation of alkanes to alkenes Tackles the use of membrane reactors in syngas, hydrogen, and basic chemical production Keen focus placed on the industry, particularly in the use of membrane reactor technologies in energy