Fly Ash in Concrete - R C Joshi - 1997-11-13
Since it was first recognized as a mineral admixture for concrete in the 1930's, fly ash has been the subject of worldwide study as researchers work to maximize its economical and environmental benefits. In recent years, investigations have focused on the physical, chemical and mineralogical characteristics of fly ash and their specific correlation to the performance of concrete. This book collects the latest results from these various studies and offers a complete review of the advantages of fly ash as an admixture in concrete, including strength development and improved chemical resistance and durability. A review of the current international standards on fly ash usage is provided, in addition to an extensive reference list and a complete survey of various other fly ash products, such as bricks, mineral wool and gypsum wall boards, as well as the use of fly ash in waste management.

Use of Fly Ash in Concrete - - 1989

Fly Ash in Concrete - K. Wesche - 2004-03-01
This book is a state-of-the-art report which documents current knowledge on the properties of fly ash in concrete and the use of fly ash in construction. It includes RILEM Recommendations on fly ash in concrete and a comprehensive bibliography including over 800 references.

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Metakaolin and Fly Ash as Mineral
The book deals with modern theoretical concepts related to the impact of fly ash and metakaolin admixtures on structure formation processes of concrete. Results of the effect of fly ash, metakaolin and their composition on properties of self-compacting and self-leveling concrete are presented. Based on mathematical models, obtained using mathematical experiments planning methodology, the impact of the main factors and their combination on workability, strength and other properties that determine efficiency and durability of concrete are analyzed. Using calculated dependencies, a methodology for designing optimal compositions of concrete containing active mineral admixtures and superplasticizers is proposed. Features of industrial production of concrete for the proposed compositions are discussed. The book is intended for specialists working in the production of concrete and reinforced concrete products and elements. It can also be used by construction engineers to design compositions of cost-effective self-compacting and self-leveling concrete as well as to determine the rational direction of using technogenic raw materials like ash and metakaolin.

**Handbook on fly ash in concrete** - Dietmar Lutze - 2013-03-20
When used as an addition and binder component, fly ash has become an indispensable construction material for many concrete applications. The conditions produced in power stations when firing fine pulverized coal result in the formation of a reactive, flour-fine, pozzolanic mineral material from the accompanying rock in the coal. Owing to its specific characteristics it has a positive impact on the properties of fresh and hardened concrete and facilitates cost-effective production of high-grade, durable concretes. The authors of this handbook have combined the latest discoveries from the field of research with practical experience of the use and effects of fly ash in concrete. This handbook provides the necessary information and makes interesting suggestions for selective use of fly ash in concrete.

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**Waste Materials Used in Concrete Manufacturing** - Satish Chandra - 1996-12-31
The environmental aspects involved in the production and use of cement, concrete and other building materials are of growing importance. CO2 emissions are 0.8-1.3 ton/ton of cement production in dry process. SO2 emission is also very high, but is dependent upon the type...
other building materials are of growing high at 100-150 KWT/ton of cement produced. It is costly to erect new cement plants. Substitution of waste materials will conserve dwindling resources, and will avoid the environmental and ecological damages caused by quarrying and exploitation of the raw materials for making cement. To some extent, it will help to solve the problem otherwise encountered in disposing of the wastes. Partial replacement of clinker or portland cement by slag, fly ash, silica fume and natural rock minerals illustrates these aspects. Partial replacement by natural materials that require little or no processing, such as pozzolans, calcined clays, etc., saves energy and decreases emission of gases. The output of waste materials suitable as cement replacement (slags, fly ashes, silica fumes, rice husk ash, etc.) is more than double that of cement production. These waste materials can partly be used, or processed, to produce materials suitable as aggregates or fillers in concrete. These can also be used as clinker raw materials, or processed into cementing systems. New grinding and mixing technology will make the use of these secondary materials simpler. Developments in chemical admixtures: superplasticizers, air entraining agents, etc., help in controlling production techniques and, in achieving the desired properties in concrete. Use of waste products is not only a partial solution to environmental and ecological problems; it significantly improves the microstructure, and consequently the durability properties of concrete, which are difficult to achieve by the use of pure portland cement. The aim is not only to make the cements and concrete less expensive, but to provide a blend of tailored properties of waste materials and portland cements suitable for specified purpose. This requires a better understanding of chemistry, and materials science. There is an increasing demand for better understanding of material properties, as well as better control of the microstructure developing in the construction material, to increase durability. The combination of different binders and modifiers to produce cheaper and more durable building materials will solve to some extent the ecological and environmental problems.

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that have been made during the period 1976 to 1984. Recommendations are made with regard to aspects of flyash concrete technology requiring further research.

**Coal Fly Ash Beneficiation** - Segun Akinyemi - 2018-01-31
The present book deals with various, very significant topics of coal fly ash beneficiation, such as treatment of acid mine drainage with coal fly ash, toxic metal adsorption using coal fly ash, recovery of metals from coal fly ash and phytoreclamation of abandoned acid mine drainage site after treatment with coal fly ash, the status of research in coal fly ash utilization and applications and some other related topics in this growing and increasingly important research area. Overall, coal fly ash beneficiation has come to assume an important role in most areas of waste management research today. Continued growth and emphasis on scientific research is expected in all areas of waste management and conversion of waste to wealth technologies.

**Waste Materials and By-Products in Concrete** - Rafat Siddique - 2007-11-13
The amount and variety of waste that humanity dumps in landfill sites is nothing short of a scandal, believes Rafat Siddique, of Deemed University in Patiala, India. Instead, we ought to be building new homes out of it! Siddique shows in this important book that many non-hazardous waste materials and by-products which are landfilled, can in fact be used in making concrete and similar construction materials.
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Fly Ash Facts for Highway Engineers -
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Production of Concrete Containing Fly Ash
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Supplementary Cementing Materials - Rafat
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This book is an attempt to consolidate the
published research related to the use of
Supplementary Cementing Materials in cement
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hardened concrete and other cement based
materials.

Methods for Evaluating Fly Ash for Use in
Highway Concrete - Lawrence L. Sutter - 2013
“TRB’s National Cooperative Highway Research
Program (NCHRP) 749: Methods for Evaluating
Fly Ash for Use in Highway Concrete presents
suggested changes to coal fly ash specifications
and test protocols contained in American
Association of State Highway and Transportation
Officials (AASHTO) Standard Specifications for
Transportation Materials and Methods of
Sampling and Testing (AASHTO M 295). The
changes suggested include modifications to the
test methods currently specified for evaluating
acceptability of fly ash for use in highway
concrete as well as the introduction of new test
methods for enhancing such evaluations.
Attachment C: Details of the Research into
Methods for Evaluating Fly Ash Use in Highway
Concrete is only available online."--Publisher
description.

Advances in Sustainable Construction
Materials - Rathish Kumar Pancharathi -

Advances in Sustainable Construction
Achieving Sustainability in Construction - Ravindra K. Dhir - 2005

THEME 1
EFFICIENT USE OF ENERGY AND RAW MATERIALS


THEME 2
POLLUTION, WASTE AND RECYCLING

Keynote Paper - Sustainability of the Cement and Concrete Industries - Development of Self Compacting Concrete for Prefabricated Street Furniture - Drying Shrinkage and Modulus of Elasticity of Sand and Total Lightweight Concretes - Construction Potential of a Mining By-Product - Refractory Properties of Insulating Materials from Secondary Cementitious Materials (SCMs) - Maximum Dosage of Glass Cullet as Fine Aggregate in Mortar - Durability Performance of Recycled Aggregate Concrete - Performance of Concrete Containing Fly Ash at Early Ages - Use of Recycling Tyre Rubber as Aggregates in Silica Fume Concrete - Engineering and Durability properties of Concrete Containing Waste Glass - Potential for Recycling Demolished Concrete and Building Rubble in Kuwait - The Manufacture of Precast Building Blocks Utilising Recycled Construction and Demolition Waste - Best Practicable Environmental Options (BPEOs) for Recycling Demolition Waste - Cost Effective and Good Performance Concrete for Sustainable Construction Through Recycling - Room Temperature Granulated Fly Ash on a Fixed Bed - As Sorbent for Organic Contaminants from Wastewater - Admixtures Effect on Mechanical Strength of a Concrete Made of Recycled Aggregate

THEME 3
MINIMISING ENVIRONMENTAL IMPACT


Achieving Sustainability in Construction - Ravindra K. Dhir - 2005

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**Advanced Computing and Intelligent Technologies** - Monica Bianchini - 2021

This book gathers selected high-quality research papers presented at International Conference on Advanced Computing and Intelligent Technologies (ICACIT 2021) held at NCR New Delhi, India, during March 2021, 2021, jointly organized by Galgotias University, India, and Department of Information Engineering and Mathematics Universita Di Siena, Italy. It discusses emerging topics pertaining to advanced computing, intelligent technologies, and networks including AI and machine learning, data mining, big data analytics, high-performance computing network performance analysis, Internet of things networks, wireless sensor networks, and others. The book offers a valuable asset for researchers from both academia and industries involved in advanced studies.

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limestone powder was also used to replace valuable asset for researchers from both academia and industries involved in advanced studies.


Carbon dioxide emission from ordinary Portland cement manufacturing is one of the major sustainability issues facing the concrete industry. In fact, the annual worldwide CO2 emission from cement manufacturing is nearly 7% of the global emissions. Roughly 60% of these emissions come from the calcination of limestone, the main raw material for making Portland-cement clinker. The remaining CO2 emission is as a result of fuel combustion required to generate the heat necessary for the reactions forming clinker. Although considerable gains in energy efficiency have been achieved during the production of cement for the last two decades, calcination of limestone is the major concern as a source of CO2 emissions. Utilization of high-volume of by-products or natural pozzolanic material, such as basaltic ash pozzolan or fly ash as a replacement of Portland cement clinker, is a possible approach to reduce the clinker factor of Portland cement. In addition, self-consolidating concrete mixtures are being increasingly used for the construction of highly reinforced complex concrete elements and for massive concrete structures such as thick foundation due to its technical advantages such as shortened placement time, labor savings, improved compaction, and better encapsulation of rebar. Self-consolidating concrete requires utilization of high dosage of a plasticizing agent or viscosity-modifying chemical admixtures. The purpose of this study is to develop highly flowable self-consolidating concrete mixtures made of high proportions of cement replacement materials such as basaltic ash pozzolan, fly ash and pulverized limestone instead of high dosage of a plasticizer or viscosity-modifying admixtures, and characterize the effects of Portland cement replacement on the strength and durability. The two replacement materials used are high-volume finely-ground basaltic ash, a Saudi Arabian aluminum-silica rich basaltic glass and high-volume Class-F fly ash, from Jim Bridger Power Plant, Wyoming US. As an extension of the study, Portland cement, alongside finely-ground basaltic ash and Class-F fly ash, forming ternary blends. Along with compressive strength tests, non-steady state chloride migration, water absorption and gas permeability tests were performed, as durability indicators, on self-consolidating concrete (SCC) specimens. The results were compared to two reference concretes; 100% ordinary Portland cement and 85% ordinary Portland cement - 15% limestone powder by weight. The high-volume of basaltic pozzolan and fly ash concrete mixtures showed strength and durability results comparable to those of the reference concretes at later ages; identifying that both can effectively be used to produce low-cost and environment-friendly self-consolidating concrete without utilizing viscosity-modifying admixture. Even though the slump flow diameter of SCC specimens was held in the similar range by utilizing varied amount of water reducer admixture, they were not identical. To enable a precise comparison among the specimens, the mortar specimens were produced that had same cement-replacement ratios with the ones in SCC specimens utilizing basaltic ash pozzolan (NP), Class-F fly ash (FA) and limestone powder without using water reducer admixture. Overall the binary and ternary FA samples had higher strength than NP mortar samples up to 1 year. This can be attributed to the higher pozzolanic reactivity of FA compared to NP which is supported by X-ray diffraction, isothermal calorimetry and thermogravimetric analysis. The normal consistency and setting time of the mixtures were determined. It showed that cement replacement with limestone powder in the ternary blended cements containing either basaltic ash pozzolan or Class-F fly ash along with ordinary Portland cement lowered the initial and final time of setting relative to the binary blended cements containing similar ratio of cement replacement. Also, the water demand of mixtures incorporate with basaltic ash pozzolan was greater than the one with Class-F fly ash. The influence of the basaltic ash pozzolan, Class-F fly ash and limestone powder in the binary and ternary Portland cement blends is discussed, while following the physicochemical changes such as crystalline transition, hydration kinetics, and mechanical property that are a direct result of the addition of supplementary cementitious material or filler. Selected cement pastes were characterized by X-ray diffraction (XRD),
Development and Characterization of...

Sustainable Self-Consolidating Concrete Containing High Volume of Limestone Powder and Natural Or Calcined Pozzolanic Materials - Kemal Celik - 2015

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**New Trends in Eco-efficient and Recycled Concrete** - Jorge de Brito - 2018-11-16

New Trends in Eco-efficient and Recycled Concrete describes different recycled materials that have been used in eco-efficient concrete,
new trends on eco-efficient concrete are presented, filling a gap in the market. Sections cover various recycled materials applied in concrete production, present the latest on the lifecycle analysis of recycled aggregate concrete, detail new trends in recycled aggregate concrete research, and finally, present updates on upscaling the use of recycled aggregate concrete and structural reliability. Focuses on new trends in recycled aggregate concrete and its applications (rather than the more subjective ‘sustainability’ aspects) Contains very important contributions from researchers in eco-efficient concrete, including Chi Sun Poon, Jorge de Brito, Valeria Corinaldesi, Francisco Agrela, etc. Presents a ‘one stop’ reference for a graduate course on sustainable construction

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This book sheds light on recent advances in sustainable construction and building materials with special emphasis on the characterization of natural and composite hydraulic mortars, advanced concrete technology, green building materials, and application of nanotechnology to the improvement of the design of building materials. The book covers in detail the characterization of natural hydraulic lime mortars, a decade of research on self-healing concrete, biocomposite cement binding process and performance, development of sustainable building materials from agro-industrial wastes, applications of sugarcane biomass ash for developing sustainable construction materials, oil-contaminated sand: sources, properties, remediation, and engineering applications, oil shale ash addition effect in concrete to freezing/thawing, connection node design and performance optimization of girders, functionally graded concrete structures, cumulative tensile damage and consolidation effects on fracture properties of sandstone, key performance criteria influencing the selection of construction methods used for the fabrication of building components in the Middle East, fly ash as a resource material for the construction industry, degradation monitoring systems for a building information modeling maintenance approach, durability of composite-modified asphalt mixtures based on inherent and improved performance, and bitumen and its modifiers.
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**Properties and Use of Coal Fly Ash** - Lindon K. A. Sear - 2001
This book draws together a large quantity of research that has been carried out on pulverised fuel ash (PFA) over the past 30 years. PFA/fly ash is produced as a by-product from burning coal and has many uses within the construction industry, such as in concrete, land reclamation, bricks and blocks, and grouting voids in the ground. In addition to covering the potential uses of PFA this book provides an overview of the benefits of its use.

**Exploiting Wastes in Concrete** - Ravindra K. Dhir - 1999
Concrete will be the key material for mankind to create the built environment of the next millennium. The requirements of this infrastructure will be both demanding, in terms of technical performance and economy, and yet be greatly varied, from architectural masterpieces to the simplest of utilities. Exploiting wastes in concrete forms the Proceedings of the one day International Seminar held during the Congress, Creating with concrete, 6-10 September 1999, organised by the concrete technology unit, University of Dundee.

**Coal Combustion Products (CCPs)** - Tom Robl - 2017-04-29
Coal Combustion Products (CCPs): Their Nature, Utilization and Beneficiation is a valuable resource for engineers and scientists from the coal, cement, concrete, and construction industries seeking an in-depth guide to the characteristics, utilization, beneficiation, and environmental impacts of coal combustion by-products. Researchers in universities working in this area will also find much to expand their knowledge. The book provides a detailed overview of the different waste materials produced during power generation from coal, exploring their nature, beneficiation techniques, applications, and environmental impacts. Strong focus is placed on coal fly ash, bottom ash, and flue gas desulfurization materials, and their employment in cement, concrete, gypsum products, aggregates, road construction, geotechnics, and agriculture, among other products and industries. Part 1 focuses on the nature of coal ashes, with chapters on their origin, generation, and storage, both in ponds and landfill. The coal combustion by-products produced as a result of clean coal technologies are the focus of the final chapter in the section. The next group of chapters in Part 2 considers the utilization of different waste materials, including the key products coal fly ash, bottom ash, and flue gas desulfurization materials. This is followed by a contribution reviewing the latest research into innovative and advanced uses for coal ash. After an introduction to ash quality problems and quality monitoring, Part 3 concentrates on the essential area of by-product beneficiation techniques, in other words how to maximize the quality of materials for the end user. Topics covered include separation methods, thermal processing, and chemical passivation. The final section of the book addresses environmental issues, including the use of coal combustion by-products in green construction materials and the essential health and safety
Coal Combustion Products (CCPs) - Tom Robl - 2017-04-29
Coal Combustion Products (CCPs): Their Nature, Utilization and Beneficiation is a valuable resource for engineers and scientists from the coal, cement, concrete, and construction industries seeking an in-depth guide to the characteristics, utilization, beneficiation, and environmental impacts of coal combustion by-products. Researchers in universities working in this area will also find much to expand their knowledge. The book provides a detailed overview of the different waste materials produced during power generation from coal, exploring their nature, beneficiation techniques, applications, and environmental impacts. Strong focus is placed on coal fly ash, bottom ash, and flue gas desulfurization materials, and their employment in cement, concrete, gypsum products, aggregates, road construction, geotechnics, and agriculture, among other products and industries. Part 1 focuses on the nature of coal ashes, with chapters on their origin, generation, and storage, both in ponds and landfill. The coal combustion by-products produced as a result of clean coal technologies are the focus of the final chapter in the section. The next group of chapters in Part 2 considers the utilization of different waste materials, including the key products coal fly ash, bottom ash, and flue gas desulfurization materials. This is followed by a contribution reviewing the latest research into innovative and advanced uses for coal ash. After an introduction to ash quality problems and quality monitoring, Part 3 concentrates on the essential area of by-product beneficiation techniques, in other words how to maximize the quality of materials for the end user. Topics covered include separation methods, thermal processing, and chemical passivation. The final section of the book addresses environmental issues, including the use of coal essential reference on the nature, reactivity, beneficiation, potential and environmental risks of coal-combustion by-products Contains an in-depth review of the origin and geochemistry of coal ash Explores the utilization of coal combustion by-products as supplementary cementitious materials to reduce the anthropomorphic greenhouse gas emissions associated with the use of ordinary Portland cement concrete Describes the essential area of the toxicology of coal combustion by-products

Geopolymer Concrete Production Using Coal Ash - Amanda Matenda - 2014
Coal powered power plants account for more than 40 percent of the electricity production of the United States. The combustion of coal results in a large number of solid waste materials, or coal combustion byproducts (CCBs). These waste materials are stored in landfill or ponds. The construction industry is heavily reliant on concrete which is used to make the building blocks for any type of structures, bricks. Concrete is a composite material made of a binder and coarse and fine aggregate. The most widely used binder in concrete production is Ordinary Portland Cement (OPC). Since cement manufacture is costly and environmentally damaging, research has increased in recent years to find a more readily available binder. This study aims at investigating the properties of Illinois fly ash as a binder in the production of geopolymer concrete. Geopolymer concrete is an innovative material made by using Alumina and Silica rich materials of geological origins as a binder as well as an alkali activated solution. Sodium Silicate and Sodium Hydroxide were used to make the activator solution of two different ratios. Geopolymer Concrete with a ratio of 1:1 of Sodium Silicate to Sodium Hydroxide reached a compressive strength above 6000 psi while samples made with a ratio of 1:2 reached a compressive strength above 4000 psi. This environmentally-friendly, green concrete was also found to have a cost comparable to conventional concrete.
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**Metakaolin and Fly Ash as Mineral Admixtures for Concrete** - Leonid Dvorkin - 2021-11-04

The book deals with modern theoretical concepts related to the impact of fly ash and metakaolin admixtures on structure formation processes of concrete. Results of the effect of fly ash, metakaolin and their composition on properties of self-compacting and self-leveling concrete are presented. Based on mathematical models, obtained using mathematical experiments planning methodology, the impact of the main factors and their combination on workability, strength and other properties that determine efficiency and durability of concrete are analyzed. Using calculated dependencies, a methodology for designing optimal compositions of concrete containing active mineral admixtures and superplasticizers is proposed. Features of industrial production of concrete for the proposed compositions are discussed. The book is intended for specialists working in the production of concrete and reinforced concrete products and elements. It can also be used by construction engineers to design compositions of cost-effective self-compacting and self-leveling concrete as well as to determine the rational direction of using technogenic raw materials like ash and metakaolin.
Fly ash, silica fume, slag & other mineral by-products in concrete. By-products in concrete. This book focuses on fly ash-based alkali-activated geopolymer concrete, its production and characteristic properties. The re-use of waste materials and industrial by-products, such as fly ash, is not only economically of interest but also helps to reduce carbon dioxide emissions. The carbon footprint of these materials is much lower than that of concrete using ordinary Portland cement. They thus offer new sustainable solutions to the construction industry. Keywords: Geopolymers, Geopolymer Concrete, Alkali-activated Geopolymer Materials (AAGM), Portland Cement, Fly Ash-based Geopolymer Concrete, Reduction of Carbon Dioxide Emissions, Concrete Applications, Self-Compacting Concrete, High-strength Concrete, High-performance Concrete.

Alternative Concrete – Geopolymer Concrete
- Adrian LĂZĂRESCU - 2021-09-05
Portland cement based concrete is the most versatile, durable and reliable building material. Unfortunately, the production of Portland cement is environmentally unfriendly. An interesting alternative is provided by alkali-activated geopolymer materials (AAGM). This book focuses on fly ash-based alkali-activated geopolymer concrete, its production and characteristic properties. The re-use of waste materials and industrial by-products, such as fly ash, is not only economically of interest but also helps to reduce carbon dioxide emissions. The carbon footprint of these materials is much lower than that of concrete using ordinary Portland cement. They thus offer new sustainable solutions to the construction industry. Keywords: Geopolymers, Geopolymer Concrete, Alkali-activated Geopolymer Materials (AAGM), Portland Cement, Fly Ash-based Geopolymer Concrete, Reduction of Carbon Dioxide Emissions, Concrete Applications, Self-Compacting Concrete, High-strength Concrete, High-performance Concrete.
Applied Coal Petrology - Isabel Suárez-Ruiz - 2008-10-09
This book is an integrated approach towards the applications of coal (organic) petrology and discusses the role of this science in the field of coal and coal-related topics. Coal petrology needs to be seen as a continuum of organic (macerals) and inorganic (minerals and trace elements) contributions to the total coal structure, with the overprint of coal rank. All this influences the behavior of coal in utilization, the coal by-products, the properties of coal as a reservoir for methane or a sequestration site for carbon dioxide, and the relationships of coal utilization with health and environmental issues. The interaction of coal properties and coal utilization begins at the mine face. The breakage of the coal in mining influences its subsequent beneficiation. Beneficiation is fundamental to the proper combustion of coal and is vital to the preparation of the feedstock for the production of metallurgical coke. An understanding of basic coal properties is important for achieving reductions in trace element emissions and improving the efficiency of combustion and combined-cycle gasification. The production of methane from coal beds is related to the properties of the in situ coal. Similarly, coal bed sequestration of carbon dioxide produced from combustion is dependent on the reservoir properties. Environmental problems accompany coal on its way from the mine to the point of utilization and beyond. Health aspects related with coal mining and coal utilization are also included because, in planning for coal use, it is impossible to separate environmental and health issues from the discussion of coal utilization. The book is aimed at a wide audience, ranging from researchers, lecturers and students to professionals in industry and discusses issues (such as the environmental, and health) that are of concern to the general public as a whole. This book focuses on the applications of coal (organic) petrology to our modern society It is an integrated approach to help the reader appreciate the importance of coal quality and mineral, trace elements) and the overprint of coal rank are treated together The book synthesises all the possibilities of the organic petrology as a tool for coal utilization in conventional applications (mining and beneficiation, coal combustion, gasification, liquefaction, carbonization), as a precursor of carbon materials and as a petroleum source and reservoir rock The role of applied petrology in the characterization of solid by-products from coal utilization is also discussed In addition, this book describes the present status of environmental and health problems linked to coal utilization and the ways in which such problems might be overcome in the future

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emissions due to fine aggregates, and emissions due to cement, fly ash, GGBFS, and admixtures. In addition, the book provides expert coverage on emissions due to concrete batching, transport and placement, and emissions generated by typical commercially produced concretes. Includes the tools and methods for reducing the emissions of greenhouse gases. Explores technologies, such as carbon capture, storage, and substitute cements. Provides essential data that helps determine the unique factors involved in designing large, new green cement plants.

**Fly Ash, Silica Fume, Slag & Other Mineral By-products in Concrete** - V. M. Malhotra - 1983

**The Alkali-Silica Reaction in Alkali-Activated Fly Ash Concrete** - Juliana Neves - 2016

The global concrete production has grown considerably over the last decades in line with the population growth, industrialization of developing countries, and the need for more infrastructures. In addition to replacing the natural environment by roads and buildings, carbon dioxide emission and depletion of natural resources for manufacturing portland cement, for example, are of major concern. The best approach to minimize the environmental impacts caused by the concrete industry is to build structures that are durable. Another valuable strategy is to manufacture concrete by using industrial by products, such as fly ash, which may fully replace portland cement. The combination of the two approaches is ideal and even more promising towards making concrete a more sustainable man-made material. This research investigates the risk of alkali-silica reaction (ASR) in alkali-activated fly ash concrete. ASR is a major deterioration mechanism, which shortens the service life of concrete structures. It involves a reaction between metastable (e.g. poorly crystalized) forms of silica in aggregates and the highly alkaline pore solution of concrete. The product of this reaction is formation of an expansive ASR gel, which cracks and damages the concrete structure. Alkali-activated fly ash (AAFA) belongs to a new generation of green concrete binders that fully replace the ordinary portland cement. AAFA binders require a highly alkaline solution.
approach to minimize the environmental impacts development, which raises the concern for ASR. In this research, the concrete prism test (ASTM C1293) was used to evaluate the ASR risk of two structural grade AAFA concretes. Despite their initially high pH and presence of highly reactive aggregate, ASTM C1293 results showed absence of deleterious expansion in these two AAFA concrete mixtures (FA1 and FA2). On the other hand, the control (i.e. OPC-based) mixture, proportioned with the same amount of reactive aggregate, exceeded the expansion threshold early during the test. SEM micrographs were used to assess the extent of aggregate deterioration and ASR gel formation in the tree mixes. The SEM micrographs reveal that aggregates in FA1 concrete were more preserved than in FA2, where very little ASR gel was detected. Moreover, EDS quantitative analysis detected increased amount of alkalis in residual aggregates with concentrations similar to that found in ASR gel formed in OPC concrete. To understand the mechanism leading to absence of ASR expansion, even though there is aggregate deterioration, microstructural investigation (MIP) and pore solution analysis were performed in AAFA pastes to test four proposed hypotheses. The results suggest that pH drop and abundance of dissolved aluminum decreases the alkaline attack to the aggregates in FA1, while the insufficient calcium prevents polymerization of dissolved silica from aggregates in FA2. In comparison to OPC paste, AAFA pastes had similar or larger porosity and average pore size, despite their significantly lower ASR activity. This rules out a hypothesis that ASR is mitigated in AAFA concrete because of its low permeability. In summary, the mechanisms responsible for absence of ASR in AAFA concretes were (1) pH drop, (2) high concentration of dissolved aluminum, and (3) low concentrations of calcium in the pore solution.

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**Sustainable Construction Materials**

- Ravindra K. Dhir OBE - 2016-10-26

Sustainable Construction Materials: Sewage Sludge Ash, part of a series of five, aims to promote the use of sustainable construction materials. It is different from the norm, with its uniqueness lying in the development of a data matrix sourced from over 600 publications and contributed by 1107 authors from 442 institutions in 48 countries from 1970 to 2016, all focusing on the subject of sewage sludge ash as a construction material, and systematically analyzing, evaluating, and modeling the information for use in cement, concrete, ceramics, geotechnics, and road pavement applications. Related environmental issues, case studies, and standards are also discussed. The book helps users avoid repetitive research and save valuable resources, giving them more latitude to explore new research to progress the use of sustainable construction materials. It is structured in an incisive and easy to digest manner. As an excellent reference source, the book is particularly suited for researchers, academics, design engineers, specifiers, contractors, developers, and certifying and regulatory authorities who seek to promote sustainability within the construction sector. Provides an extensive source of valuable database information supported by an exhaustive and comprehensively organized list of globally published literature spanning 40-50 years, up to 2016, with 5000 references Offers an analysis, evaluation, repackaging, and modeling of existing knowledge, encouraging more responsible use of waste materials in construction Presents a wealth of knowledge for use in many sectors relating to the construction profession

**Fly Ash**

- Jacob Parker - 2017-03

Coal fly ash (CFA) is one of the most complex anthropogenic materials. It is estimated that only about 20 to 30% of the globally generated fly ash is employed and utilised in building materials mainly as an additive in cement, concrete, and structural filling as well as in small scale production of zeolite. This book provides new research on the characteristics, uses and performance of fly ash.

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