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Combustion of Liquid Fuel Sprays outlines the fundamentals of the combustion of sprays in a unified way which may be applied to any technological application. The book begins with a discussion of the general nature of spray combustion, the sources of liquid fuels used in spray combustion, biomass sources of liquid fuels, and the nature and properties of fuel oils. Subsequent chapters focus on the properties of sprays, the atomization of liquid fuels, and the theoretical modeling of the behavior of a spray flame in a combustion chamber. The nature and control of pollutants from spray combustion, the formation of deposits in oil-fired systems, and the combustion of sprays in furnaces and engines are elucidated as well. The text is intended for students undertaking courses or research in fuel, combustion, and energy studies.

Xxi, 551 leaves ill. 29 cm.

Carbon monoxide (CO) is a toxic air pollutant produced largely from vehicle emissions. Breathing CO at high concentrations leads to reduced oxygen transport by hemoglobin, which has health effects that include impaired reaction timing, headaches, lightheadedness, nausea, vomiting, weakness, clouding of consciousness, coma, and, at high enough concentrations and long enough exposure, death. In recognition of those health effects, the U.S. Environmental Protection Agency (EPA), as directed by the Clean Air Act, established the health-based National Ambient Air Quality Standards (NAAQS) for CO in 1971. Most areas that were previously designated as "nonattainment" areas have come into compliance with the NAAQS for CO, but some locations still have difficulty in attaining the CO standards. Those locations tend to have topographical or meteorological characteristics that exacerbate pollution. In view of the challenges posed for some areas to attain compliance with the NAAQS for CO, congress asked the National Research Council to investigate the problem of CO in areas with meteorological and topographical problems. This interim report deals specifically with Fairbanks, Alaska. Fairbanks was chosen as a case study because its meteorological and topographical characteristics make it susceptible to severe winter inversions that trap CO and other pollutants at ground level.

Energy is the issue of great importance at the present. Coal, the cheapest and the most abundant reserve fossil fuel, is currently one of the most widely used energy source globally and will continue to be in the foreseeable future. The use of coal has also posed many world-wide environmental challenges, including the control of particulate matter, mercury, and trace metals, and carbon oxide (CO2) emissions. The rising of CO2 level in the atmosphere due to burning of fossil fuels is one of the major factors contributing to the global climate change. Capturing CO2 from coal combustion exhaust has been receiving significant attention; however, the volume fraction of CO2 in conventional coal combustion system (with air) ranges only 13%-15%, making it difficult to cost-effectively design the systems. Oxy-coal combustion or O2/CO2 recycled coal combustion is one of the promising techniques to overcome the limitation of low CO2 concentration in the exhaust. Before this technology can be employed, the effects of oxy-coal combustion on the pollutants associated with coal combustion, including fine particle, gaseous mercury and heavy metal emissions, need to be established. In addition, the influences of oxy-coal combustion on the performance of the current pollution control technologies, such as an electrostatic precipitator (ESP), need to be addressed. This dissertation investigated two aspects of coal combustion process: (1) pollutant formation, specifically submicrometer particles and mercury, and (2) pollutant control. The first part of dissertation addresses the impact of oxy-coal combustion on the formation submicrometer particles and the speciation of gaseous mercury. The second part focuses on the performance of two pollutant control technologies, including an ESP for capturing submicrometer particles and nano-structured TiO2 with UV irradiation for mercury capture. The findings presented here can be broadly divided into three parts. The first part reports the influence of oxy-coal combustion on submicrometer particle formation and capture using an ESP. The second part addresses the impacts of oxy-coal combustion on mercury speciation. The third part investigates the performance of nano-structured sorbent for capturing mercury and controlling heavy metal emissions from combustion process. The findings presented here can be used as a guideline for proper operation and control of pollutants generated from both oxy-coal and conventional combustion systems.

This reference overflows with an abundance of experimental techniques, simulation strategies, and practical applications useful in the control of pollutants generated by combustion processes in the metals, minerals, chemical, petrochemical, waste, incineration, paper, glass, and foods industries. The book assists engineers as they attempt to meet e

"Greenhouses are controlled growth environments that can regulate and isolate a controlled atmosphere from external disturbances to optimize plant growth. In northern climates, it is often necessary to provide additional heat to the greenhouse environment, since cool external temperatures limit the growth of plants year-round. In addition, plant growth is improved by elevating the plant growth space with carbon dioxide above ambient levels, increasing the plants photosynthetic rate.Biofuels utilizing woody biomass are considered a carbon neutral source of fuel that can be easily utilized to generate heat and carbon dioxide. However, during the combustion process, various gaseous pollutants are produced. These include pollutants that are harmful to human health (such as particulate matter) and pollutants that are harmful to plants (such as ethylene). Since the combustion reaction cannot be efficiently improved to prevent the formation of these pollutants, downstream filtration technologies are required to remove these flue gases. The FlueTRU system is a novel filtration system that was designed and constructed at Macdonald Campus of McGill University. The FlueTRU system has been connected to a Caddy II furnace inside an experimental hoop house for the purpose of testing low cost, high efficiency air filtration technologies. The system is comprised of three separate sections that are designed to remove different gaseous pollutants.The Electrostatic Precipitator Cyclone (E.P.C) is a duel technology filtration system designed to remove particulate matter. It consists of an initial cyclone to filter out large particulate matter and fly ash, followed by a second step cylindrical electrostatic precipitator. Initial results have shown a removal efficiency of approximately 95 percent when the chamber is charged, and the longest experimental run performed has been 10 hours.The Heat Destruction Element (H.D.E) is the third step and is an applied thermal oxidation chamber that utilizes heat generated by high voltage resistive wires to remove unwanted volatile organic carbon (V.O.C) molecules from the airstream. The system is able to heat the airstream to over 850 degrees Celsius, which is sufficient to completely oxidize the ethylene. In addition, this temperature can oxidize sulfur dioxide and carbon monoxide, reducing their concentrations to 0.01 and approximately 30 parts per million respectively." --

This handbook is an important and valuable source for engineers and researchers in the area of internal combustion engines pollution control. It provides an excellent updated review of available knowledge in this field and furnishes essential and useful information on air pollution constituents, mechanisms of formation, control technologies, effects of engine design, effects of operation conditions, and effects of fuel formulation and additives. The text is rich in explanatory diagrams, figures and tables, and includes a considerable number of references. An important resource for engineers and researchers in the area of internal combustion engines and pollution control Presents and excellent updated review of the available knowledge in this area Written by 23 experts Provides over 700 references and more than 500 explanatory diagrams, figures and tables

Incineration has been used widely for waste disposal, including household, hazardous, and medical wasteâ€"but there is increasing public concern over the benefits of combusting the waste versus the health risk from pollutants emitted during combustion. Waste Incineration and Public Health informs the emerging debate with the most up-to-date information available on incineration, pollution, and human healthâ€"along with expert conclusions and recommendations for further research and improvement of such areas as risk communication. The committee provides details on: Processes involved in incineration and how contaminants are released. Environmental dynamics of contaminants and routes of human exposure. Tools and approaches for assessing possible human health effects. Scientific concerns pertinent to future regulatory actions. The book also examines some of the social, psychological, and economic factors that affect the communities where incineration takes place and addresses the problem of uncertainty and variation in predicting the health effects of incineration processes.

The construction industry is bombarded with ever-changing building materials—components of which are more and more difficult, if not impossible, to identify. Building material emissions have been implicated as a major source of indoor air pollution, and toxic gases, often unidentified, are generated in building fires. Building Materials: Product Emission and Combustion Health Hazards undertakes the task of identifying building materials emission and combustion health hazards. This practical guide introduces the complex world of polymers commonly used in building materials along with plasticizers and additives that are not regulated by OSHA. It also explores the topic of building materials as they relate to function and their emissions/combustion products along with thermal decomposition and combustion products as they relate to fire first responders. Engaging environmental professionals, construction management firms, architects, first respondents, and students, this valuable reference delivers a comprehensive spectrum of knowledge needed to face the challenges of managing building materials in the twenty-first century. Awareness is the first line of defense!

This book considers the pollutants formed by the combustion of solid biomass fuels. The availability and potential use of solid biofuels is first discussed because this is the key to the development of biomass as a source of energy. This is followed by details of the methods used for characterisation of biomass and their classification. The various steps in the combustion mechanisms are given together with a compilation of the kinetic data. The chemical mechanisms for the formation of the pollutants: NOx, smoke and unburned hydrocarbons, SOx, Cl compounds, and particulate metal aerosols are given in detail. Combustion kinetics required for the application for design purposes are given. Examples are given of emission levels of a range different types of combustion equipment. Data is given of NOx, particulates and other pollutant arising from combustion of different fuels in fixed bed combustion, fluidized bed combustion and pulverised biomass combustion and co-firing. Modeling methods including computational fluid dynamics for the various pollutants are outlined. The consequential issues arising from the wide scale use of biomass and future trends are then discussed. In particular the role of carbon capture and storage in large biomass combustion plants is considered as well as the opportunity of reducing the concentration of atmospheric concentration of carbon dioxide.

The objective of this study is to compare combustion pollutants produced from biogas &, their fossil fuel counterpart, natural gas to determine optimum combustion conditions. The analysis was broken up into pollutant classification, combustion model selection, and regression model selection. Pollutants are evaluated based on global warming potential, local air quality standards, and effective heat transfer in order to determine which combustion conditions are preferable. The four pollutants that are considered are carbon dioxide (CO2), nitrous oxide (N2O), nitrogen oxide (NOX), and carbon monoxide (CO). The combustion model utilized for this study was a Chemkin perfectly stirred reactor with kinetic pathways created by the CRECK Polimi Database. The Chemkin model was chosen to replicate a boiler and would run combustion scenarios with varying amounts of heat extracted from the combustion chamber to control the combustion temperature. In order to rank the combustion outputs, a logistic regression was developed using the least toxic outcomes to make a threshold for the combustion processes. All this information makes a strong framework to classify the data produced for the study and any additional data that are generated. The results of the study made it clear that there is no combustion condition in which all the pollutants can be minimized, mainly because the carbon monoxide levels rebound as the combustion temperature falls. However, the study did determine that reducing the combustion temperature and the relative methane content of the fuel air mixture results in lower pollutant outputs. The relative methane contents effect on the combustion pollutants was determined by the fuel gases performing better as the biogas content was increased.

A rigorous and thorough analysis of the production of air pollutants and their control, this text is geared toward chemical and environmental engineering students. Topics include combustion, principles of aerosol behavior, theories of the removal of particulate and gaseous pollutants from effluent streams, and air pollution control strategies. 1988 edition.Reprint of the Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1988 edition.

Exposure to particulate matter (PM) air pollution is the world's largest environmental health risk accounting for millions of premature deaths and disability-adjusted life years annually. PM originates from natural and anthropogenic sources such as dust from soil, combustion engines, and forest fires, among many others. PM exposure is quantified by measuring its mass concentration in air. This mea-

surement alone does not identify the sources of PM exposure, which can inform effective mitigation strategies and allow for studying source-specific health effects. There are several options for source apportionment (e.g. GC-MS and X-ray fluorescence), but they are costly and time consuming to conduct. Alternative methods for source apportionment using low-cost techniques would be beneficial to the study of air pollution and its health effects. In this dissertation, I develop a method for source apportionment of combustion generated PM using fluorescent Excitation Emission Matrix (EEM) fluorescent spectroscopy and machine learning. First, I collected PM samples from combustion sources of concern to human health in the laboratory. I analyzed cyclohexane extracts of cigarette smoke, diesel exhaust and wood smoke by EEM fluorescent spectroscopy and using the World Health Organization's guideline for annual mean PM exposure of 10 [mirco]g/m3 as a basis of comparison I show EEM is sensitive enough to detect combustion generated PM at levels well below those of concern to human health. Next, mixtures of the same laboratory sources are analyzed using EEM. Combining measurements of the individual sources with those of mixtures, I apply several machine learning techniques and a simple linear model to perform source apportionment and identification from the mixtures and compare the results. A convolutional neural network (CNN) is found to have the best performance of all methods investigated. I describe in detail the architecture and data augmentation approach used for the CNN. Finally, the EEM-Machine Learning approach is used for source apportionment of environmental samples. Results and filter samples from an exposure assessment panel study are used for this analysis. The samples were analyzed using X-ray fluorescence and source apportionment was conducted using Positive Matrix Factorization. Filters, archived in a freezer, were extracted with cyclohexane and analyzed by EEM. The resulting EEM spectra and source contribution estimates from PMF were used as training data for the application of machine learning. A CNN with the same architecture as applied to the laboratory samples and Principal Component Regression showed similar results in predicting contributions from combustion generated PM. These methods were able to reproduce the XRF-PMF results with R2 values as high as 0.84 for vegetative burning and 0.52 for traffic emissions.

The indoor air quality of residential buildings was characterized to determine the types, rates of emissions, and fates of gaseous and particulate air pollutants from typical indoor combustion appliances. Measurements were conducted in occupied residential buildings and during controlled laboratory experiments with combustion appliances. The SO2, NO, NO2, O3, CO, and CO2 concentrations and aerosol size distribution were determined on a continuous basis. Total and respirable-fraction particulate samples were collected on membrane filter media for analysis by x-ray fluorescence (XRFA), photoelectron spectroscopy (ESCA), proton activation analysis (PAA), combustion, and wet--chemistry techniques for the determination of particulate elemental composition (S, N, C, etc.) and ionic species such as SO4/sup 2 -/, NO3−, and NH4. Results of the study indicate that the concentrations of some gaseous and respirable particulate air pollutants in the indoor environment exceed those levels commonly found in the outdoor urban air environment. Such findings may have a large impact on the future design of epidemiology studies, on energy conservation strategies for buildings, and on the need for more stringent control of air pollution from indoor combustion sources.

This reference overflows with an abundance of experimental techniques, simulation strategies, and practical applications useful in the control of pollutants generated by combustion processes in the metals, minerals, chemical, petrochemical, waste, incineration, paper, glass, and foods industries. The book assists engineers as they attempt to meet emerging environmental regulations and decrease combustion-induced pollutants in the modern industrial era. Brimming with more than 1300 references and 750 tables, figures, and illustrations, Industrial Combustion Pollution and Control reduces theory and provides a wide spectrum of schemes useful for system construction and planning.

This dissertation focusses on indoor concentrations of pollutants (TSP, Carbon monoxide and Barium phosphide) emitted by Indian cookstoves. Experiments in a simulated village hut (SVH) determined size distribution of particulates from burning of fuelwood and cowdung, and investigated the effects of fuel, ventilation condition and sampling location on TSP, CO and BaP concentrations. 84 to 99 % of the total particulate mass in wood and dung smoke had aerodynamic diameter less than 3.2 micro, which eliminated the need for particle size discriminating sampling. These experiments finalized the field sampling protocol. The field survey included 291 households in three central and two south Indian villages. The kitchens had either thatched or tiled roofs with a variety of volumes and open spaces on the walls. Fixed monitoring was done at roof, medium and low levels close to stove or chula (cemented to floor) and personal sampler on the cook monitored air in her breathing zone. (mjm).

This book presents WHO guidelines for the protection of public health from risks due to a number of chemicals commonly present in indoor air. The substances considered in this review, i.e. benzene, carbon monoxide, formaldehyde, naphthalene, nitrogen dioxide, polycyclic aromatic hydrocarbons (especially benzo[a]pyrene), radon, trichloroethylene and tetrachloroethylene, have indoor sources, are known in respect of their hazardousness to health and are often found indoors in concentrations of health concern. The guidelines are targeted at public health professionals involved in preventing health risks of environmental exposures, as well as specialists and authorities involved in the design and use of buildings, indoor materials and products. They provide a scientific basis for legally enforceable standards.

This environmental information handbook was prepared to assist both the non-technical reader (i.e., homeowner) and technical persons (such as researchers, policy analysts, and builders/designers) in understanding the current state of knowledge regarding combustion sources of indoor air pollution. Quantitative and descriptive data addressing the emissions, indoor concentrations, factors influencing indoor concentrations, and health effects of combustion-generated pollutants are provided. In addition, a review of the models, controls, and standards applicable to indoor air pollution from combustion sources is presented. The emphasis is on the residential environment. The data presented here have been compiled from government and privately-funded research results, conference proceedings, technical journals, and recent publications. It is intended to provide the technical reader with a comprehensive overview and reference source on the major indoor air quality aspects relating to indoor combustion activities, including tobacco smoking. In addition, techniques for determining potential concentrations of pollutants in residential settings are presented. This is an update of a 1985 study documenting the state of knowledge of combustion-generated pollutants in the indoor environment. 191 refs., 51 figs., 71 tabs.

Industry relies heavily on the combustion process. The already high demand for energy, primarily from combustion, is expected to continue to rapidly increase. Yet, the information is scattered and incomplete, with very little attention paid to the overall combustion system. Designed for practicing engineers, Heat Transfer in Industrial Combustion e

The use of coal is required to help satisfy the world's energy needs. Yet coal is a difficult fossil fuel to consume efficiently and cleanly. We believe that its clean and efficient use can be increased through improved technology based on a thorough understanding of fundamental physical and chemical processes that occur during consumption. The principal objective of this book is to provide a current summary of this technology. The past technology for describing and analyzing coal furnaces and combus tors has relied largely on empirical inputs for the complex flow and chemical reactions that occur while more formally treating the heat-transfer effects. GrOWing concern over control of combustion-generated air pollutants revealed a lack of understanding of the relevant fundamental physical and chemical mechanisms. Recent technical advances in computer speed and storage capacity, and in numerical prediction of recirculating turbulent flows, two-phase flows, and flows with chemical reaction have opened new opportunities for describing and modeling such complex combustion systems in greater detail. We believe that most of the requisite component models to permit a more fundamental description of coal combustion processes are available. At the same time there is worldwide interest in the use of coal, and progress in modeling of coal reaction processes has been steady.

This collection of notes was assembled as a supplement and guide to a five-day short course presented at the University of California at Berkeley, September 22-26, 1969. The scope of subject matter, while limited to combustion as a source of air pollution, at the same time is intended to give the broadest possible exposure within that area. The spectrum is deliberately wide, ranging from fundamen tals of combustion and combustion reactions through performance of combustion systems and to legal and administrative control. Contributors to this compendium and lecturers in the subject were solicited from academic and public organizations. Most of the authors are from the statewide University of California and the California Department of Public Health. Notable individuals with particular ex pertise, from other institutions, were also invited to contribute. The choice of instructor in each case was based upon a desire to col lect a cross-section of outstanding individuals, each highly qualified technically in his field. These notes reflect the freedom which each author was encouraged to follow in providing supplementary material for his lecture. The staff of Continuing Education in Engineering, Professor Thomas Hazlett and Daphne Stern, deserve commendation for their effective and successful handling of the innumerable details which were encountered. Professors Robert Sawyer and Laurence Caretto are herewith gratefully acknowledged for their support in the seemingly uncountable tasks ne cessary to assemble the entity which is represented.

This book aims to strengthen the knowledge base dealing with Air Pollution. The book consists of 21 chapters dealing with Air Pollution and its effects in the fields of Health, Environment, Economy and Agricultural Sources. It is divided into four sections. The first one deals with effect of air pollution on health and human body organs. The second section includes the Impact of air pollution on plants and agricultural sources and methods of resistance. The third section includes environmental changes, geographic and climatic conditions due to air pollution. The fourth section includes case studies concerning of the impact of air pollution in the economy and development goals, such as, indoor air pollution in México, indoor air pollution and millennium development goals in Bangladesh, epidemiologic and economic impact of natural gas on indoor air pollution in Colombia and economic growth and air pollution in Iran during development programs. In this book the authors explain the definition of air pollution, the most important pollutants and their different sources and effects on humans and various fields of life. The authors offer different solutions to the problems resulting from air pollution.