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Guest Editor: Prof. Dr. Yonmo Sung
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Guest Editors: Prof. Dr. Antonella Ingenito and Prof. Dr. Claudio Bruno
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Section Information:

The "Energy and Environment" Section covers all topics at the interface of energy and the environment that are of interest to the science and engineering communities. Special focus is given to progress in research and applications associated with the development and evaluation of technological and administrative pathways that minimize the environmental impacts of energy life cycles.

Scope:

Example topic areas within the scope of our journal's "Energy and Environment" Section are listed below. This list is neither exhaustive nor exclusive:

- Advanced Technologies for Environmentally Friendly Energy Systems
- Environmental Impacts of Energy Production
- Environmental Sustainability Assessments
- Sustainability of Renewable Energies
- Water-Energy-Environment Nexus

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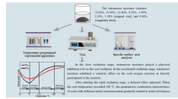
Section Energy and Environment

Featured Papers

DOI: 10.3390/en13081969

Study on the Effect of Extraneous Moisture on the Spontaneous Combustion of Coal and Its Mechanism of Action

Authors: Yuguo Wu, Yulong Zhang, Jie Wang, Xiaoyu Zhang, Junfeng Wang and Chunshan Zhou

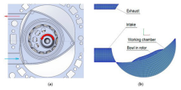


Abstract: It is imperative to have an in-depth understanding of the effect of extraneous moisture on the spontaneous combustion of coal not only for the control and prevention of coal spontaneous combustion in the coal mining industry, but also for the optimization design and application of the technological process. In this study, the type of moisture in a coal body has been redefined for the first time from the perspective of disaster prevention and control, i.e., original occurrence of moisture in the coal matrix and the extraneous moisture from the technological process. A suit of coal bodies with different extraneous moisture was prepared by soaking long-flame coal with a low water content. Using a temperature-programmed oxidation test, the effects of extraneous moisture on the temperature increase rate of coal bodies and the emission characteristics of gaseous products during coal spontaneous combustion were studied. Moreover, combined with the characterization of thermal analysis and of pore structure test, the action the mechanism of extraneous moisture on the coal spontaneous combustion process was also explored. The experimental results indicated that the effect of the extraneous moisture content varied with the development of coal spontaneous combustion. In the slow oxidation stage, extraneous moisture played a physical inhibition role in the coal oxidation. In the accelerated oxidation stage, extraneous moisture exhibited a catalytic effect on the coal–oxygen reaction or directly participated in the reaction. After entering the rapid oxidation stage, a delayed effect appeared. When the coal temperature exceeded 180 °C, the spontaneous combustion characteristics of coals with different initial moisture contents gradually tended to achieved balance.

DOI: 10.3390/en12122292

Improvement of Combustion Process of Spark-Ignited Aviation Wankel Engine

Authors: Lev Finkelberg, Alexander Kostuchenkov, Andrei Zelentsov and Vladimir Minin

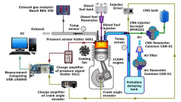


Abstract: This paper deals with the creation of modern high-performance aircraft power units based on the Wankel rotary piston engine. One of the main problems of Wankel engines is high specific fuel consumption. This paper solves the problem of improving the efficiency of this type of engine. The mathematical model of non-stationary processes of transfer of momentum, energy, mass, and the concentration of reacting substances in the estimated volume provides for the determination of local gas parameters in the entire computational region, which are presented as a sum of averaged and pulsation components. The k-ζ-f model is used as the turbulence model; the combustion is described by the coherent flame model (CFM) based on the concept of laminar flame propagation. As a result of the calculation, we obtained the values of temperature, pressure, and velocity of the working fluid in the working chamber cross-sections of a rotary–piston engine. Various options of the rotor recess shape are considered. Based on the data obtained, the rotor design was improved. The offered shape of the rotor recess has reduced emissions of both nitrogen oxides and carbon dioxide.

DOI: 10.3390/en12203857

An Experimental Study on the Performance and Emission of the diesel/CNG Dual-Fuel Combustion Mode in a Stationary CI Engine

Authors: Arkadiusz Jamrozik, Wojciech Tutak and Karol Grab-Rogaliński

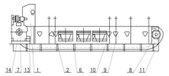


Abstract: One of the possibilities to reduce diesel fuel consumption and at the same time reduce the emission of diesel engines, is the use of alternative gaseous fuels, so far most commonly used to power spark ignition engines. The presented work concerns experimental research of a dual-fuel compression-ignition (CI) engine in which diesel fuel was co-combusted with CNG (compressed natural gas). The energy share of CNG gas was varied from 0% to 95%. The study showed that increasing the share of CNG co-combusted with diesel in the CI engine increases the ignition delay of the combustible mixture and shortens the overall duration of combustion. For CNG gas shares from 0% to 45%, due to the intensification of the combustion process, it causes an increase in the maximum pressure in the cylinder, an increase in the rate of heat release and an increase in pressure rise rate. The most stable operation, similar to a conventional engine, was characterized by a diesel co-combustion engine with 30% and 45% shares of CNG gas. Increasing the CNG share from 0% to 90% increases the nitric oxide emissions of a dual-fuel engine. Compared to diesel fuel supply, co-combustion of this fuel with 30% and 45% CNG energy shares contributes to the reduction of hydrocarbon (HC) emissions, which increases after exceeding these values. Increasing the share of CNG gas co-combusted with diesel fuel, compared to the combustion of diesel fuel, reduces carbon dioxide emissions, and almost completely reduces carbon monoxide in the exhaust gas of a dual-fuel engine.

DOI: 10.3390/en13092208

Selected Aspects of Combustion Optimization of Coal in Power Plants

Authors: Maciej Dzikuć, Piotr Kuryło, Rafał Dudziak, Szymon Szufa, Maria Dzikuć and Karolina Godzisz



Abstract: Growing ecological standards force the implementation of solutions that will contribute to reducing greenhouse gas (GHG) emissions to the atmosphere. This is particularly important in Poland, whose energy system is almost 80% based on coal. In the interest of low carbon development it is worth considering the optimization of existing old coal-based power plants. The main goal of the research was to present the benefits of modernization of existing boiler equipment and to analyze the combustion process of various types of coal sorts that have a significant impact on the optimization of the production processes of energy media. An analysis of the processes occurring in boiler devices during the combustion of fuel was carried out, which had a significant impact on the quality of generated heat and electricity. The conducted research defined technological solutions for boiler structures that have a significant impact on improving the efficiency of the technological process in heating plants and the characteristics of coal as energy fuel. Practical technical and modernization solutions have been proposed that contribute to the optimization of coal combustion processes, resulting in increased energy efficiency of the heating plant.