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Editor-in-Chief

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Section Information

This Section on Energy Science and Technology invites high quality unpublished multidisciplinary research and review articles on state-of-the-art energy technology. We encourage articles in the areas of energy conversion and efficiency, renewable and sustainable energy sources, including their applications, energy storage, and harvesting, energy transportation, smart grid, internet of energy, etc., covering all three major facets of energy in generation, transmission, and distribution. Applied Sciences in general and this Section on Energy Science and Technology in particular offers a high-quality peer review followed by a rapid publication decision.

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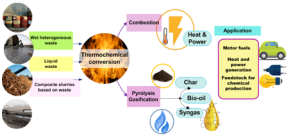
Featured Papers

DOI:10.3390/app12031039

Combustion, Pyrolysis, and Gasification of Waste-Derived Fuel Slurries, Low-Grade Liquids, and High-Moisture Waste: Review

Authors: Ksenia Vershinina, Galina Nyashina and Pavel Strizhak

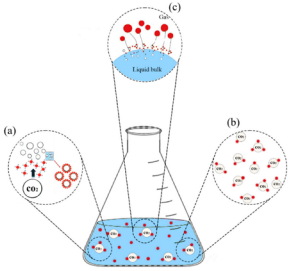


Abstract: The article discusses the modern achievements in the field of thermal recovery of industrial and municipal waste. The average accumulation rate and calorific value of typical wastes were analyzed. The focus is on the opportunities to exploit the energy potential of high-moisture waste, low-grade liquid components, and fuel slurries. We consider the relevant results in the field of combustion, pyrolysis, and gasification of such fuels. The main attention is paid to synergistic effects, the influence of additives, and external conditions on the process performance. Vortex combustion chambers, boilers with burners, and nozzles for fuel injection, grate, and fluidized bed boilers can be used for the combustion of waste-derived liquid, high-moisture, and slurry fuels. The following difficulties are possible: long ignition delay, incomplete combustion, low combustion temperature and specific calorific value, high emissions (including particulate matter, polycyclic aromatic hydrocarbons), fast slagging, and difficult spraying. A successful solution to these problems is possible due to the use of auxiliary fuel; boiler modifications; oxy-fuel combustion; and the preparation of multi-component fuels, including the use of additives. An analysis of methods of waste recovery in the composition of slurries for fuel gas production showed that there are several main areas of research: pyrolysis and gasification of coal–water slurry with additives of oil waste; study of the influence of external conditions on the characteristics of final products; and the use of specialized additives and catalysts to improve the efficiency of the pyrolysis and gasification. The prospects for improving the characteristics of thermochemical conversion of such fuels are highlighted.

DOI:10.3390/app12063200

Application of Nanofluids in CO_2 Absorption: A Review

Authors: Babak Aghel, Sara Janati,Falah Alobaid, Adel Almoslh and Bernd Epple

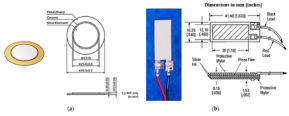


Abstract: The continuous release of CO_2 into the atmosphere as a major cause of increasing global warming has become a growing concern for the environment. Accordingly, CO_2 absorption through an approach with maximum absorption efficiency and minimum energy consumption is of paramount importance. Thanks to the emergence of nanotechnology and its unique advantages in various fields, a new approach was introduced using suspended particles in a base liquid (suspension) to increase CO_2 absorption. This review article addresses the performance of nanofluids, preparation methods, and their stability, which is one of the essential factors preventing sedimentation of nanofluids. This article aims to comprehensibly study the factors contributing to CO_2 absorption through nanofluids, which mainly addresses the role of the base liquids and the reason behind their selection.

DOI:10.3390/app12063010

Detection and Analysis of Partial Discharges in Oil-Immersed Power Transformers Using Low-Cost Acoustic Sensors

Authors: Hamidreza Besharatifard, Saeed Hasanzadeh, Ehsan Heydarian-Forushani, Hassan Haes Alhelou and Pierluigi Siano

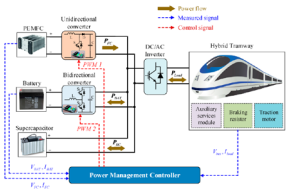


Abstract: Partial Discharge (PD) is one of the symptoms of an electrical insulation problem, and its permanence can lead to the complete deterioration of the electrical insulation in high-voltage equipment such as power transformers. The acoustic emission (AE) method is a well-known technique used to detect and localize PD activity inside oil-filled transformers. However, the commercially available monitoring systems based on acoustic sensors still have a high cost. This paper analyses the ability of low-cost piezoelectric sensors to identify PDs within oil-filled power transformers. To this end, two types of low-cost piezoelectric sensors were fully investigated using time-domain, frequency-domain, and time-frequency analysis, separately. Thereafter, the effectiveness of these sensors for PD detection and monitoring was studied. A three-phase distribution transformer filled with oil was examined. PDs were produced inside an oil-immersed transformer by applying a high voltage over two copper electrodes, and the AE sensors were coupled to the housing of the transformer. By extracting typical features from the AE signals, the PD signals were differentiated from on-site noise and interference. The AE signals were analyzed using acoustic signal metrics such as peak value, energy criterion, and other statistical parameters. The obtained results indicated that the used low-cost piezoelectric sensors have the capability of PD monitoring within power transformers.

DOI:10.3390/app12083880

Development of Fuzzy-Adaptive Control Based Energy Management Strategy for PEM Fuel Cell Hybrid Tramway System

Authors: Hoai-An Trinh, Hoai-Vu-Anh Truong and Kyoung Kwan Ahn



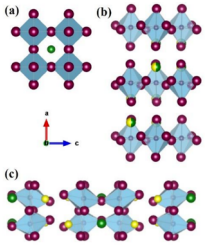
Abstract: Currently, the implementation of hybrid proton-exchange membrane fuel cell (PEMFC)-battery-supercapacitor systems for hybrid tramways to replace conventional internal combustion engines and reduce greenhouse gas emissions has triggered an upward trend in developing energy management strategies (EMSs) to effectively deploy this integration. For this purpose, this paper introduces a comprehensive EMS consisting of high-level and low-level controls to achieve appropriate power distribution and stabilize the operating voltage of the powertrain. In the high-level control, a fuzzy logic technique and adaptive control loop are proposed to determine the reference power for energy sources under different working conditions. Meanwhile, the low-level control aims to generate a pulse-width-modulation (PWM) signal for DC/DC converter, associated with each electric source, to regulate the device's output performance and guarantee the DC bus voltage. Comparisons between the proposed strategy with available approaches are conducted to verify the effectiveness of the proposed EMS through MATLAB/Simulink environment. The simulation results confirm that the proposed EMS not only sufficiently ensures powers distribution even when the abrupt changes of load or high peak power, but also enhance the efficiency of the PEMFC, in which the PEMFC stack efficiency can be exhibited up to 53% with hydrogen consumption less than 21.4%. Moreover, the DC bus voltage can be regulated with a small ripple of around 1%.

DOI:10.3390/app12084082

Protonic Transport in Layered Perovskites $BaLa_nIn_nO3_{n+1}$ (n = 1, 2) with Ruddlesden-Popper Structure

Authors: Nataliia Tarasova, Anzhelika Galisheva, Irina Animitsa,Daniil Korona, Hala Kreimesh and Irina Fedorova

Abstract: The work focused on the layered perovskite-related materials as the potential electrolytic components of such devices as proton conducting solid oxide fuel cells for the area of clean energy. The two-layered perovskite $BaLa_2In_2O_7$ with the Ruddlesden–Popper structure was investigated as a protonic conductor for the first time. The role of increasing the amount of perovskite blocks in the layered structure on the ionic transport was investigated. It was shown that layered perovskites $BaLa_nIn_nO3_{n+1}$ (n = 1, 2) demonstrate nearly pure protonic conductivity below 350 °C.



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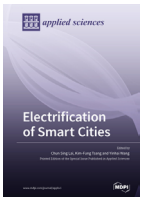

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