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Section

Thermal Management

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Section Editor-in-Chief

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Section Information:

Thermal Management is the ability to control the temperature of a system by means of Technology based on Thermodynamics, Fluid Dynamics and Heat and Mass Transfer. The phrase Thermal Management is therefore describing all possible means and processes like conduction, convection, boiling, condensation, radiation, etc. to increase or decrease the temperature and/or the temperature distribution of a specified system. This Section applied novel research about the development and demonstration of components, equipment, technologies and systems involving thermal processes for the production, storage, utilization, and conservation of energy and thermal devices for the transport of heat or insulation. Example topics include:

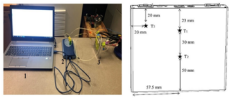
- Components and Equipment
- Thermofluids
- Physical Phenomena and Analysis
- Renewable and Clean Energy Technologies
- Component through to System Design
- Economic assessments

Featured Papers

DOI: 10.3390/en14133881

Comprehensive Passive Thermal Management Systems for Electric Vehicles

Authors: Hamidreza Behi, Danial Karimi, Rekabra Youssef, Mahesh Suresh Patil, Joeri Van Mierlo and Maitane Berecibar

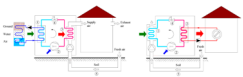


Abstract: Lithium-ion (Li-ion) batteries have emerged as a promising energy source for electric vehicle (EV) applications owing to the solution offered by their high power, high specific energy, no memory effect, and their excellent durability. However, they generate a large amount of heat, particularly during the fast discharge process. Therefore, a suitable thermal management system (TMS) is necessary to guarantee their performance, efficiency, capacity, safety, and lifetime. This study investigates the thermal performance of different passive cooling systems for the LTO Li-ion battery cell/module with the application of natural convection, aluminum (Al) mesh, copper (Cu) mesh, phase change material (PCM), and PCM-graphite. Experimental results show the average temperature of the cell, due to natural convection, Al mesh, Cu mesh, PCM, and PCM-graphite compared with the lack of natural convection decrease by 6.4%, 7.4%, 8.8%, 30%, and 39.3%, respectively. In addition, some numerical simulations and investigations are solved by COMSOL Multiphysics®, for the battery module consisting of 30 cells, which is cooled by PCM and PCM-graphite. The maximum temperature of the battery module compared with the natural convection case study is reduced by 15.1% and 17.3%, respectively. Moreover, increasing the cell spacing in the battery module has a direct effect on temperature reduction.

DOI: 10.3390/en14082134

Application and Design Aspects of Ground Heat Exchangers

Authors: Luka Boban, Dino Miše, Stjepan Herceg and Vladimir Soldo



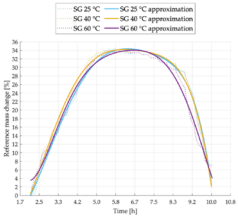
Abstract: With the constant increase in energy demand, using renewable energy has become a priority. Geothermal energy is a widely available, constant source of renewable energy that has shown great potential as an alternative source of energy in achieving global energy sustainability and environment protection. When exploiting geothermal energy, whether is for heating or cooling buildings or generating electricity, a ground heat exchanger (GHE) is the most important component, whose performance can be easily improved by following the latest design aspects. This article focuses on the application of different types of GHEs with attention directed to deep vertical borehole heat exchangers and direct expansion systems, which were not dealt with in detail in recent reviews. The article gives a review of the most recent advances in design aspects of GHE, namely pipe arrangement, materials, and working fluids. The influence of the main design parameters on the performance of horizontal, vertical, and shallow GHEs is discussed together with commonly used performance indicators for the evaluation of GHE. A survey of the available literature shows that thermal performance is mostly a point of interest, while hydraulic and/or economic performance is often not addressed, potentially resulting in non-optimal GHE design.

DOI: 10.3390/en14041083

Effect of Additives on the Sorption Kinetics of a Silica Gel Bed in Adsorption Chiller

Authors: Karol Sztekler, Wojciech Kalawa, Łukasz Mika, Agata Mlonka-Medrala, Marcin Sowa and Wojciech Nowak

Abstract: The article presents experimental results of the metal-based and carbon nanotube additives influence on sorption kinetics of a silica-gel-based adsorption bed in an adsorption chiller. The purpose of the doping is to improve the efficiency of sorption processes within the bed by use of metallic and non-metallic additives characterized by higher thermal diffusivity than basic adsorption material. The higher the thermal conductivity of the bed, the faster the sorption processes take place, which directly translates into greater efficiency of the refrigerator. In this study, sorption kinetics of pure silica gel sorbent doped with a given amount of aluminum (Al) and copper (Cu) powders and carbon nanotubes (CNT) were analyzed. The tests were performed on DVS Dynamic Gravimetric Vapor Sorption System apparatus used for dynamic vapor sorption measurements. A decrease in the amount of adsorbed water was observed with an increase in the mass share of the additives in the performed studies. Experimental results show that, CNTs seems to be the most promising additive as the sorption process time was reduced with the smallest decrease in water uptake. Any significant reduction of adsorption time was noted in case of the Al addition. Whereas, in case of Cu doping, delamination of the mixture was observed.

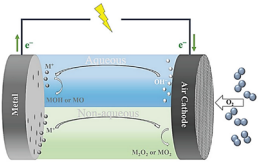


DOI: 10.3390/en14217373

Metal-Air Batteries—A Review

Authors: Abdul Ghani Olabi, Enas Taha Sayed, Tabbi Wilberforce, Aisha Jamal, Abdul Hai Alami, Khaled Elsaid, Shek Mohammod Atiqure Rahman, Sheikh Khaleduzzaman Shah, and Mohammad Ali Abdelkareem

Abstract: Metal–air batteries are a promising technology that could be used in several applications, from portable devices to large-scale energy storage applications. This work is a comprehensive review of the recent progress made in metal-air batteries MABs. It covers the theoretical considerations and mechanisms of MABs, electrochemical performance, and the progress made in the development of different structures of MABs. The operational concepts and recent developments in MABs are thoroughly discussed, with a particular focus on innovative materials design and cell structures. The classical research on traditional MABs was chosen and contrasted with metal–air flow systems, demonstrating the merits associated with the latter in terms of achieving higher energy density and efficiency, along with stability. Furthermore, the recent applications of MABs were discussed. Finally, a broad overview of challenges/opportunities and potential directions for commercializing this technology is carefully discussed. The primary focus of this investigation is to present a concise summary and to establish future directions in the development of MABs from traditional static to advanced flow technologies. A systematic analysis of this subject from a material and chemistry standpoint is presented as well.



Selected Special Issues list in Section

Advances in Heat Transfer and Combustion in Turbomachinery
Guest Editors: Dr. Antonio Andreini and Dr. Lorenzo Mazzei
Deadline: **20 July 2022**

Control, Simulation, and Monitoring of Thermal Processes in Power Plants
Guest Editor: Dr. Pawel Madejski
Deadline: **25 July 2022**

Research and Development on Indirect Evaporative Cooling Technology
Guest Editors: Prof. Dr. Eric Hu and Dr. Hamed Sadighi Dizaji
Deadline: **1 August 2022**

Recent Advances in Organic Rankine Cycle (ORC)
Guest Editors: Prof. Dr. Tzu-Chen Hung, Dr. Yong-Qiang Feng and Dr. Huan Xi
Deadline: **31 August 2022**

New Insights into Heat Recovery and Air Conditioning
Guest Editors: Dr. Sławomir Rabczak, Prof. Dr. Daniel Słyś and Dr. Krzysztof Nowak
Deadline: **10 August 2022**

Analysis and Optimization of Cooling Performance in Gas Turbines
Guest Editor: Dr. Jiang Lei
Deadline: **30 September 2022**

Advanced Computational Fluid Dynamics Modeling
Guest Editors: Prof. Dr. Ishak Bin Hashim, Dr. Hussein A. Z. AL-bonsrulah, Dr. Dhinakaran Veeman and Dr. Mogalahalli V. Reddy
Deadline: **18 November 2022**

Heat Transfer Enhancement and Fluid Flow Features Due to the Addition of Nanoparticles in Engineering Applications
Guest Editors: Dr. Basma Souayeh, Prof. Dr. Kashif Ali Abro and Dr. Suvanjan Bhattacharyya
Deadline: **31 December 2022**

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