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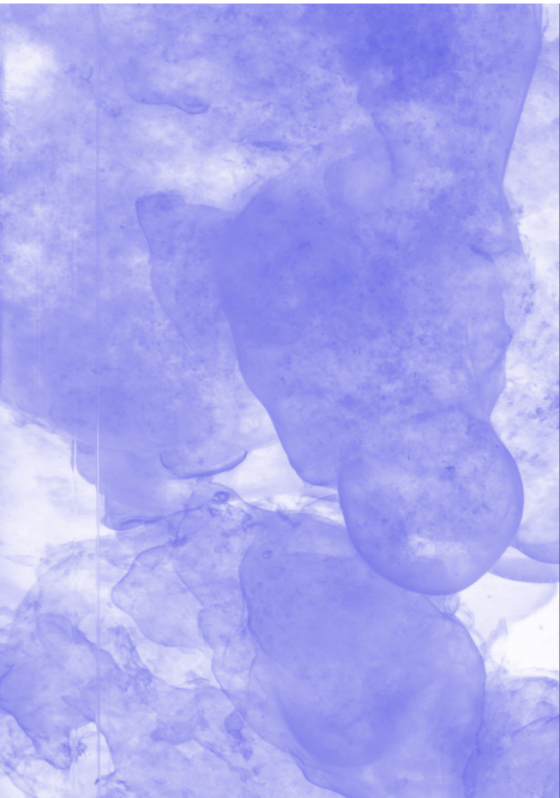
Section
Applied Thermal Engineering



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Section Information

Applied Thermal Engineering is open to receiving high-quality state-of-the-art reviews, original full research, short communications, and case studies, covering all technologies based on heat transfer processes. Therefore, challenging works dealing with applied thermodynamic problems up to real applications are welcomed in this section. Both theoretical and experimental works with rigorous and replicable methodology can be submitted in this section.
Both basic and applied research and anything in between is acceptable in this section, and many different applications can be covered, such as domestic, commercial, industrial, marine, aeronautics, aerospatial, transport, primary/secondary/tertiary sector, and clean energy.

- Heat transfer problems
- Energy conversion
- Combustion
- Cycles
- Mini- and micro-channels
- Heat transfer technologies
- Zero-emission technologies
- 4E analysis

Section Editor-in-Chief
Prof. Dr. Yuyang Li

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A first decision is provided to authors approximately 19.8 days after submission; acceptance to publication is undertaken in 2.6 days (median values for papers published in this journal in the first half of 2025)

Selected Papers

A Review of Small-Scale Vapor Compression Refrigeration Technologies

Authors: Juan Carlos Silva-Romero, Juan Manuel Belman-Flores and Salvador M. Aceves

Abstract: The study and development of miniature refrigeration and climate conditioning systems based on vapor compression for small-scale applications have received wide interest in recent years due to their advantages compared with other available technologies, both active and passive. This paper identifies different applications and areas of opportunity, including electronic components and personal cooling, where small-scale vapor compression refrigeration systems are anticipated to play a key role in technological development. This paper presents the current state of the art, including applications, component designs, operating conditions, experiments, published results, etc. to describe the current status of small-scale vapor compression refrigeration and illustrate a perspective for the future of this technology.

https://doi.org/10.3390/app14073069

Recycling of Low-Quality Carbon Black Produced by Tire Pyrolysis

Authors: Ergo Rikmann, Uno Mäeorg and Jüri Liiv

Abstract: Pyrolysis is a promising way to reuse of waste tires. However, the carbon black generated in the process is often contaminated with various pyrolysis products. This study aims to recycle low-quality recycled carbon black (rCB) from waste tire pyrolysis, addressing the challenges posed by organic residues (up to 5 wt% bituminous substances, 112.2 mg/kg PAH). This causes the agglomeration of particles and decreases the active specific surface area. Cavitational vortex milling (both wet and dry) emerges as a promising method to valorize contaminated rCB, allowing for a significant reduction in the concentration of contaminants. This novel method allows for the generation of hydrophilic and hydrophobic black pigments. In parallel experiments, low-quality rCB is incorporated into solid biofuel to enhance its calorific value. The addition of 10 wt% rCB) to peat residues significantly elevates the calorific value from 14.5 MJ/kg to 21.0 MJ/kg. However, this improvement is accompanied by notable increases in CO_2 and SO_2 emissions. This dual effect underscores the necessity of considering environmental consequences when utilizing recycled carbon black as a supplement to solid biofuels. The findings provide valuable insights into the potential of cavitational vortex milling for carbon black valorization and highlight the trade-offs associated with enhancing biofuel properties through the addition of rCB.

https://doi.org/10.3390/app14052192

Decarbonizing European Industry: A Novel Technology to Heat Supply Using Waste and Renewable Energy

Authors: José Daniel Marcos, Iman Golpour, Rubén Barbero and Antonio Rovira

Abstract: This study examines the potential for the smart integration of waste and renewable energy sources to supply industrial heat at temperatures between 150 °C and 250 °C, aiming to decarbonize heat demand in European industry. This work is part of a European project (SUSHEAT) which focuses on developing a novel technology that integrates several innovative components: a Stirling cycle high-temperature heat pump (HTHP), a bio-inspired phase change material (PCM) thermal energy storage (TES) system, and a control and integration twin (CIT) system based on smart decision-making algorithms. The objective is to develop highly efficient industrial heat upgrading systems for industrial applications using renewable energy sources and waste heat recovery. To achieve this, the specific heat requirements of different European industries were analyzed. The findings indicate that industrial sectors such as food and beverages, plastics, desalination, textiles, ceramics, pulp and paper, wood products, canned food, agricultural products, mining, and chemicals, typically require process heat at temperatures below 250 °C under conditions well within the range of the SUSHEAT system...

https://doi.org/10.3390/app14198994

Modeling and Analysis of a Radiative Thermal Memristor

Authors: Ambali Alade Odebowale, Andergachew Mekonnen Berhe, Haroldo T. Hattori and Andrey E. Miroshnichenko

Abstract: This study presents a theoretical framework for a radiative thermal memristor (RTM), utilizing Tungsten-doped vanadium dioxide (WVO) as the phase-change material (PCM) and silicon carbide (SiC) in the far-field regime. The behavior of the RTM is depicted through a Lissajous curve, illustrating the relationship between net flux (Q) and a periodically modulated temperature difference $\Delta T(t)$. It is established that temperature variations in the memristance (M) of the RTM form a closed loop, governed by PCM hysteresis. The analysis explores the impact of thermal conductivity contrast (r) and periodic thermal input amplitude (θ) on the Q–ΔT curve and the M–ΔT curve and negative differential thermal resistance (NDTR), revealing notable effects on the curve shapes and the emergence of NDTR. An increasing r leads to changes in the Lissajous curve's shape and enhances the NDTR influence, while variations in both r and (θ) significantly affect the Q values and Lissajous curve amplitudes. In the M–ΔT curve, the height is linked to thermal conductivity contrast (r), with increasing r resulting in higher curve heights.

https://doi.org/10.3390/app14062633

Techniques for Enhancing Thermal Conductivity and Heat Transfer in Phase Change Materials in Hybrid Phase Change Material–Water Storage Tanks

Authors: Dmytro Shmyhol, Miroslav Rimár, Marcel Fedak, Tibor Krenický, Martin Lopušniak and Nikolas Polivka

Abstract: In recent years, extensive research has been dedicated to enhancing energy efficiency and promoting environmental sustainability in heating and cooling systems. Among the promising solutions, phase change materials (PCM) technology stands out as a key area of exploration. This study focuses on improving the thermal performance of PCM–water hybrid tanks by investigating methods to enhance thermal conductivity and heat transfer. Through experimental testing using techniques such as copper matrices, steel twisted matrices, and copper spirals, this study demonstrates significant improvements in thermal conductivity, particularly with the use of copper matrices. The integration of a copper matrix placed in the PCM reservoir increased the heat transfer coefficient and thermal conductivity of the PCM, and thus, the total phase transformation time for solidification was reduced by 79.19% and for melting by 54.7%. Our experimental results demonstrate that the integration of a copper matrix can increase latent heat transfer from 55,677.6 J up to 125,274.6 J, marking a 125% enhancement over the experiment with pure PCM. Additionally, comparisons of the energy storage potentials for different PCMs underscore the benefits of integrating PCMs into hybrid storage tanks. These findings highlight the immense potential of PCM technology to increase energy storage efficiency in heating and cooling applications.

https://doi.org/10.3390/app14093732

Invitation to Submit

Solar Thermal Energy: Conversion, Storage, and Utilization

Guest Editors: Dr. Rosa Christodoulaki and Prof. Dr. Irene P. Koronaki
Deadline: 15 December 2025

Thermal Analysis and Its Applications in Materials Science and Engineering

Guest Editors: Dr. Maryna Shevtsova and Dr. Renata Boris
Deadline: 20 January 2026

Technical Advances in Combustion Engines

Guest Editors: Dr. Stefano Marrone and Dr. Laura Verde
Deadline: 20 January 2026

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