Heat Transfer Enhancement With Nanofluids A Thesis

Applications of Nanofluid for Heat Transfer Enhancement
Microscale and Nanoscale Heat Transfer
Numerical Simulation
Heat Transfer Enhancement of Spray Cooling with Nanofluids
Preparation, Characterization and Applications
Analysis, Design, and Application
Nanoparticle Heat Transfer and Fluid Flow
Heat Transfer Enhancement in Straight Channel with Nanofluid in Fully Developed Turbulent Flow
Hybrid Nanofluids
Nanofluid Enhancement of Mineral Oil and Thermal Properties Instrument Design
From Energy to Drug Delivery
Nanofluids and Mass Transfer
An Investigation of Heat Transfer Enhancement in Nanofluids Containing Core and Shell Nanoparticles
Nanofluids
From Numerical to Experimental Techniques
Select Proceedings of ICETME 2018
Heat Transfer Enhancement in Nano-fluids Suspensions
Heat Transfer Enhancement Using Nanofluids
Design, Applications and Performance
Heating, Ventilating, and Air Conditioning
Advances in Heat Transfer Enhancement
Alumina Nanofluid for Spray Cooling Heat Transfer Enhancement
Heat Transfer Enhancement Using Nanofluid Flow in Microchannels
Analysis and Design
Microfluidics and Nanofluidics
Nanofluid in Heat Exchanges for Mechanical Systems

Engineering Applications of Nanotechnology
Heat Transfer Enhancement in Microchannel Heat Sink Using Nanofluids
Nanofluid Heat Transfer Enhancement in Engineering Applications
Select Proceedings of ICAMER 2019
Advances in New Heat Transfer Fluids
Applications of Nanofluid Transportation and Heat Transfer Simulation
Heat Transfer Enhancement in a Rectangular Duct by Using Winglet and Nanofluids
Nanofluid Heat and Mass Transfer in Engineering Problems
Electronics Cooling
Nanotechnology for Energy Sustainability
Investigation of the Pool Boiling Heat Transfer Enhancement of Nano-engineered Fluids by Means of High-speed Infrared Thermography
Science and Technology
Advances in Applied Mechanical Engineering

GONZALES TALIYAH

Applications of Nanofluid for Heat Transfer Enhancement CRC Press

Featuring contributions by leading researchers in the field, Nanoparticle Heat Transfer and Fluid Flow explores heat transfer and fluid flow processes in nanomaterials and nanofluids, which are becoming increasingly important across the engineering disciplines. The book covers a wide range, from biomedical and energy conversion applications to materials properties, and addresses aspects that are essential for further progress in the field, including numerical quantification, modeling, simulation, and presentation. Topics include: A broad review of nanofluid applications, including industrial heat transfer, biomedical engineering, electronics, energy conversion, membrane filtration, and automotive An overview of thermofluids and their importance in biomedical applications and heat-transfer enhancement A deeper look at biomedical applications such as nanoparticle hyperthermia treatments for cancers Issues in energy conversion from dispersed forms to more concentrated and utilizable forms Issues in nanofluid properties, which are less predictable and less repeatable than those of other media that participate in fluid flow and heat transfer Advances in computational fluid dynamic (CFD) modeling of membrane filtration at the microscale The role of nanofluids as a coolant in microchannel heat transfer for the thermal management of electronic equipment The potential enhancement of natural convection due to nanoparticles Examining key topics and applications in nanoscale heat transfer and fluid flow, this comprehensive book presents the current state of the art and a view of the future. It offers a valuable resource for experts as well as newcomers interested in developing innovative modeling and numerical simulation in this growing field.

Microscale and Nanoscale Heat Transfer BoD – Books on Demand

In the recent decades, efficiency enhancement of refineries and chemical plants has been become a focus of research and development groups. Use of nanofluids in absorption, regeneration, liquid-liquid extraction and membrane processes can lead to mass transfer and heat transfer enhancement in processes which results in an increased efficiency in all these processes. Nanofluids and Mass Transfer introduces the role of nanofluids in improving mass transfer phenomena and expressing their characteristics and properties. The book also covers the theory and modelling procedures in details and finally illustrates various applications of Nanofluids in mass transfer enhancement in various processes such as absorption, regeneration, liquid-liquid extraction and membrane processes and how can nanofluids increase mass transfer in processes. Introduces specifications of nanofluids and mechanisms of mass transfer enhancement by nanofluids in various mass transfer processes Discusses mass transfer enhancement in various mass transfer processes such as: absorption, regeneration, liquid-liquid extraction and membrane processes Offers modelling mass transfer and flow in nanofluids Challenges industrialization and scale up of nanofluids

Numerical Simulation BoD – Books on Demand

Studies of fluid flow and heat transfer in a porous medium have been the subject of continuous interest for the past several decades because of the wide range of applications, such as geothermal systems, drying technologies, production of thermal isolators, control of pollutant spread in groundwater, insulation of buildings, solar power collectors, design of nuclear reactors, and compact heat exchangers, etc. There are several models for simulating porous media such as the Darcy model, Non-Darcy model, and non-equilibrium model. In porous media applications, such as the environmental impact of buried nuclear heat-generating waste, chemical reactors, thermal energy transport/storage systems, the cooling of electronic devices, etc., a temperature discrepancy between the solid matrix and the saturating fluid has been observed and recognized.

Heat Transfer Enhancement of Spray Cooling with Nanofluids Elsevier

Nanofluids are gaining the attention of scientists and researchers around the world. This new category of heat transfer medium improves the thermal conductivity of fluid by suspending small solid particles within it and offers the possibility of increased heat transfer in a variety of applications. Bringing together expert contributions from across the globe, Heat Transfer Enhancement with Nanofluids presents a complete understanding of the application of nanofluids in a range of fields and explains the main techniques used in the analysis of nanofuids flow and heat transfer. Providing a rigorous framework to help readers develop devices employing nanofluids, the book addresses basic topics

that include the analysis and measurements of thermophysical properties, convection, and heat exchanger performance. It explores the issues of convective instabilities, nanofluids in porous media, and entropy generation in nanofluids. The book also contains the latest advancements, innovations, methodologies, and research on the subject. Presented in 16 chapters, the text: Discusses the possible mechanisms of thermal conduction enhancement Reviews the results of a theoretical analysis determining the anomalous enhancement of heat transfer in nanofluid flow Assesses different approaches modeling the thermal conductivity enhancement of nanofluids Focuses on experimental methodologies used to determine the thermophysical properties of nanofluids Analyzes forced convection heat transfer in nanofluids in both laminar and turbulent convection Highlights the application of nanofluids in heat exchangers and microchannels Discusses the utilization of nanofluids in porous media Introduces the boiling of nanofluids Treats pool and flow boiling by analyzing the effect of nanoparticles on these complex phenomena Indicates future research directions to further develop this area of knowledge, and more Intended as a reference for researchers and engineers working in the field, Heat Transfer Enhancement with Nanofluids presents advanced topics that detail the strengths, weaknesses, and potential future developments in nanofluids heat transfer.
Preparation, Characterization and Applications LAP Lambert Academic Publishing
There are two purposes of this research, to design and build a heat transfer cell that could accurately calculate heat transport coefficients of various fluids and to determine if the increased heat transfer capabilities of nanofluids can be applied to cooling transformers by using the heat transfer cell to measure the enhancement. The design and construction of a heat transfer cell that could accurately calculate heat transport coefficients of various fluids was successful. A heat transfer cell was built and tested on several fluids to confirm the accuracy of the design and the experiments. Three fluids were successfully tested overall for their thermal conductivity values, and one fluid was tested for its convection coefficients in the heat transfer cells. Values for the thermal conductivity and the convection coefficients were obtained during this experiment that agreed with commonly accepted values for the testing fluids. The average value for the thermal conductivities for mineral oil of the first design in the 1/4" diameter cell is 0.15 w/m2c, and agrees well with the commonly accepted values of mineral oils. The value commonly accepted value of thermal conductivity for mineral oil is 0.14 w/m2c at 25°C, the first heat transfer cell yielded a thermal conductivity value of approximately 0.16 w/m2c at roughly 25C. The heat transfer cell was also used to calculated convection coefficients of mineral oil, and values were obtained within the limits for natural convection according to Incropera, contributing more to the validity of the results from this heat transfer cell. A second heat transfer cell was designed to determine the thermal conductivities of more thermally sensitive fluids, offering a wider range of materials that can be tested. The second design places the thermocouples directly at their assumed position of the wire and the wall temperatures for calculation purposes, yielding more accurate results and can therefore more accurately calculate the thermal conductivities of various fluids. The second design

calculated a thermal conductivity of water to be 0.59 w/m2c, while the commonly accepted value is 0.58 w/m2c, which is well within a tolerable range of error to accept this value as accurate at the experimental conditions. This heat transfer cell also calculated the thermal conductivity value for AMSOIL synthetic motor oil to be 0.12 w/m2c and 0.10 w/m2c for mineral oil, both of these values are within the expected ranges of thermal conductivity for oils. The second goal of applying the heat transfer enhancement properties of a nanofluid to a transformer cooling application proved to be futile for Copper Oxide(40nm) and Carbon coated Copper nanoparticles(25nm) in mineral oil. All of the attempted nanofluids fell out of suspension within a timeframe of a day, and in a transformer cell where natural convection is the only means of flow available that contributes to keeping the nanoparticles suspended, there is not enough flow to keep the nanoparticles from falling out of suspension. That is why unless the transformer industry moves towards another coolant besides mineral oil, heat transfer enhancement using Copper Oxide (40nm) or Carbon Coated nanoparticles (25nm) in a mineral oil nanofluid is not a viable option.

Analysis, Design, and Application Springer

Heat Transfer Enhancement Using Nanofluid Flow in Microchannels: Simulation of Heat and Mass Transfer focuses on the numerical simulation of passive techniques, and also covers the applications of external forces on heat transfer enhancement of nanofluids in microchannels. Economic and environmental incentives have increased efforts to reduce energy consumption. Heat transfer enhancement, augmentation, or intensification are the terms that many scientists employ in their efforts in energy consumption reduction. These can be divided into (a) active techniques which require external forces such as magnetic force, and (b) passive techniques which do not require external forces, including geometry refinement and fluid additives. Gives readers the knowledge they need to be able to simulate nanofluids in a wide range of microchannels and optimise their heat transfer characteristics Contains real-life examples, mathematical procedures, numerical algorithms, and codes to allow readers to easily reproduce the methodologies covered, and to understand how they can be applied in practice Presents novel applications for heat exchange systems, such as entropy generation minimization and figures of merit, allowing readers to optimize the techniques they use Focuses on the numerical simulation of passive techniques, and also covers the applications of external forces on heat transfer enhancement of nanofluids in microchannels

Nanoparticle Heat Transfer and Fluid Flow WIT Press

Hybrid Nanofluids: Preparation, Characterization and Applications presents the history of hybrid nanofluids, preparation techniques, thermoelectrical properties, rheological behaviors, optical properties, theoretical modeling and correlations, and the effect of all these factors on potential applications, such as solar energy, electronics cooling, heat exchangers, machining, and refrigeration. Future challenges and future work scope have also been included. The information from this book enables readers to discover novel techniques, resolve existing research limitations, and create novel hybrid nanofluids which can be implemented for heat transfer applications. Describes the characterization, thermophysical and electrical properties of nanofluids Assesses parameter selection and property measurement techniques for the calibration of thermal performance Provides information on theoretical models and correlations for predicting hybrid nanofluids properties from experimental properties

Heat Transfer Enhancement in Straight Channel with Nanofluid in Fully Developed Turbulent Flow Springer Science & Business Media

Based on the most recent standards from ASHRAE, the sixth edition provides complete and up-to-date coverage of all aspects of heating, ventilation, and air conditioning. The latest load calculation procedures, indoor air quality procedures, and issues related to ozone depletion are covered. New to this edition is the inclusion of additional realistic, interactive and in-depth examples available on the book website (www.wiley.com/college/mcquiston) that enable students to simulate various scenarios to apply concepts from the text. Also integrated throughout the text are numerous worked examples that clearly show students how to apply the concepts in realistic scenarios. The sixth edition has also been revised to be more accessible to students for easier comprehension. Suitable for one or two semester, Junior/Senior/Graduate course in HVAC taught in Mechanical Engineering, Architectural Engineering, and Mechanical Engineering Technology departments.

Hybrid Nanofluids William Andrew

Featuring contributions from the renowned researchers and academicians in the field, this book covers key conventional and emerging cooling techniques and coolants for electronics cooling. It includes following thematic topics: - Cooling approaches and coolants - Boiling and phase change-based technologies - Heat pipes-based cooling - Microchannels cooling systems - Heat loop cooling technology - Nanofluids as coolants - Theoretical development for the junction temperature of package chips. This book is intended to be a reference source and guide to researchers, engineers, postgraduate students, and academicians in the fields of thermal management and cooling technologies as well as for people in the electronics and semiconductors industries.

Nanofluid Enhancement of Mineral Oil and Thermal Properties Instrument Design Anchor Academic Publishing

In three handy volumes, this ready reference provides a detailed overview of nanotechnology as it is applied to energy sustainability. Clearly structured, following an introduction, the first part of the book is dedicated to energy production, renewable energy, energy storage, energy distribution, and energy conversion and harvesting. The second part then goes on to discuss nano-enabled materials, energy conservation and management, technological and intellectual property-related issues and markets and environmental remediation. The text concludes with a look at and recommendations for future technology advances. An essential handbook for all experts in the field - from academic researchers and engineers to developers in industry.

From Energy to Drug Delivery William Andrew

Heat Transfer Enhancement with NanofluidsCRC Press

Nanofluids and Mass Transfer Elsevier

This Brief addresses the phenomena of heat transfer enhancement. A companion edition in the SpringerBrief Subseries on Thermal Engineering and Applied Science to three other monographs including “Critical Heat Flux in Flow Boiling in Microchannels,” this volume is idea for professionals, researchers, and graduate students concerned with electronic cooling.

An Investigation of Heat Transfer Enhancement in Nanofluids Containing Core and Shell Nanoparticles CRC Press

(Cont.) Critical heat flux enhancement in nanofluids of up to 100% was experimentally observed. The cause of this enhancement was determined to be the decreased static contact angle of nanofluid boiled surfaces. The increased wettability modified the growth of bubbles prior to CHF and promoted rewetting of hotspots at CHF. In parallel quenching tests, rewetting temperatures and velocities were simultaneously measured for the first time. Surfaces that had been pre-boiled in nanofluids were found to have significantly higher rewetting temperatures and velocities than clean surfaces. Interpretation of the experimental data was conducted with consideration of the governing surface parameters and existing models. It was found that there is significant room for improvement of most pool boiling models, especially with regard to surface effects. The research performed in this thesis help demonstrate the power of the infrared thermography technique and its potential for future improvement of boiling models.

Nanofluids Heat Transfer Enhancement with Nanofluids

The purpose of this research is to determine the differences in heat transfer enhancement of poly alpha olefin oil after the addition of two types of carbon coated nanoparticles, specifically carbon coated cobalt and carbon coated copper nanoparticles. The carbon shell allows for the nanoparticles to be homogenously dispersed in the oil and remain stable throughout the experimental procedure. The nanofluids were prepared in concentrations of 0.5, 1.0, and 1.5 wt%. A constant surface heat flux testing rig is used to determine the heat transfer coefficients of the base fluids and the nanofluids. Inlet temperatures to the heat transfer section of the rig and flow rate of the fluid are varied to allow analysis of the impact of fluid temperature and Reynolds number. Testing occurred at temperatures of 50, 65, and 90 oC and fluid flow rates of 10 to 100 mL/s. The carbon coated copper nanoparticles showed the largest heat transfer enhancement at a fluid temperature of 65oC and at a loading concentration of 1.0 wt%. In general heat transfer enhancement decreased as both particle concentration and fluid temperature increased. The carbon coated cobalt nanoparticles exhibited the largest heat transfer enhancement at a fluid temperature of 90 oC and a particle concentration of 1.5 wt%. Heat transfer enhancement generally increased as both temperature and particle concentration increased. Overall heat transfer enhancement by the carbon coated copper nanoparticles was larger than the enhancement provided by the carbon coated cobalt nanoparticles at the same flow rate, temperature, and concentration. This is attributed to the higher thermal conductivity of copper metal.

BoD – Books on Demand

This book comprises select proceedings of the International Conference on Emerging Trends in Mechanical Engineering (ICETME 2018). The book covers various topics of mechanical engineering like computational fluid dynamics, heat transfer, machine dynamics, tribology, and composite materials. In addition, relevant studies in the allied fields of manufacturing, industrial and production engineering are also covered. The applications of latest tools and techniques in the context of mechanical engineering problems are discussed in this book. The contents of this book will be useful for students, researchers as well as industry professionals.

From Numerical to Experimental Techniques John Wiley & Sons

Plate-and-frame heat exchangers (PHEs) are used in many different processes at a broad range of temperatures and with a variety of substances. Research into PHEs has increased considerably in recent years and this is a compilation of knowledge on the subject. Containing invited contributions from prominent and active investigators in the area, it should enable graduate students, researchers, and research and development engineers in industry to achieve a better understanding of transport processes. Some guidelines for design and development are also included.

Select Proceedings of ICETME 2018 Academic Press

Turbulent nanofluids flows in Rib-Groove channel are numerically investigated. The continuity, momentum and energy equations were solved by means of a finite volume method (FVM). A commercial CFD package, FLUENT, is used to perform the modeling and simulation. Different Rib-Groove shapes are used (Rectangular Rib, Triangular Rib, Trapezoidal Rib, Rectangular Groove, Triangular Groove, and Trapezoidal Groove). Four different types of Nanoparticles (Al_2O_3, CuO, SiO_2, and ZnO) with different volumes fractions in the range (0-4)% and different nanoparticle diameters in the range (25-80)nm, are dispersed in the base fluid (water, glycerin and engine oil) are used. In this study, several parameters such as different Reynolds numbers in the range of 5000

Heat Transfer Enhancement in Nano-fluids Suspensions Elsevier

While robust progress has been made towards the practical use of nanofluids, uncertainties remain concerning the fundamental effects of nanoparticles on key thermo-physical properties. Nanofluids have higher thermal conductivity and single-phase heat transfer coefficients than their base fluids. The possibility of very large thermal conductivity enhancement in nanofluids and the associated physical mechanisms are a hotly debated topic, in part because the thermal conductivity database is sparse and inconsistent. This thesis reports on the International Nanofluid Property Benchmark Exercise (INPBE) in which the thermal conductivity of identical samples of colloidally stable dispersions of nanoparticles, or 'nanofluids', was measured by over 30 organizations worldwide, using a variety of experimental approaches, including the transient hot wire method, steady-state methods and optical methods. The nanofluids tested were comprised of aqueous and non-aqueous basefluids, metal and metal oxide particles, near-spherical and elongated particles, at low and high particle concentrations. The data analysis reveals that the data from most organizations lie within a relatively narrow band (± 10% or less) about the sample average, with only few outliers. The thermal conductivity of the nanofluids was found to increase with particle concentration and aspect ratio, as expected from classical theory. The effective medium theory developed for dispersed particles by Maxwell in 1881, and

recently generalized by Nan et al., was found to be in good agreement with the experimental data. The nanofluid literature contains many claims of anomalous convective heat transfer enhancement in both turbulent and laminar flow. To put such claims to the test, we have performed a critical detailed analysis of the database reported in 12 nanofluid papers (8 on laminar flow and 4 on turbulent flow). The methodology accounted for both modeling and experimental uncertainties in the following way. The heat transfer coefficient for any given data set was calculated according to the established correlations (Dittus-Boelter's for turbulent flow and Shah's for laminar flow). The uncertainty in the correlation input parameters (i.e. nanofluid thermo-physical properties and flow rate) was propagated to get the uncertainty on the predicted heat transfer coefficient. The predicted and measured heat transfer coefficient values were then compared to each other. If they differed by more than their respective uncertainties, we called the deviation anomalous. According to this methodology, it was found that in nanofluid laminar flow in fact there seems to be anomalous heat transfer enhancement in the entrance region, while the data are in agreement (within uncertainties) with the Shah's correlation in the fully developed region. On the other hand, the turbulent flow data could be reconciled (within uncertainties) with the Dittus-Boelter's correlation, once the temperature dependence of viscosity was included in the prediction of the Reynolds number. While this finding is plausible, it could not be directly confirmed, because most papers do not report information about the temperature dependence of the viscosity for their nanofluids.
Heat Transfer Enhancement Using Nanofluids IGI Global
In the present book, nanofluid heat and mass transfer in engineering problems are investigated. The use of additives in the base fluid like water or ethylene glycol is one of the techniques applied to augment heat transfer. Newly, innovative nanometer-sized particles have been dispersed in the base fluid in heat transfer fluids. The fluids containing the solid nanometer-sized particle dispersion are called "nanofluids." At first, nanofluid heat and mass transfer over a stretching sheet are provided with various boundary conditions. Problems faced for simulating nanofluids are reported. Also, thermophysical properties of various nanofluids are presented. Nanofluid flow and heat transfer in the presence of magnetic field are investigated. Furthermore, applications for electrical and biomedical engineering are provided. Besides, applications of nanofluid in internal combustion engine are provided.
Design, Applications and Performance John Wiley & Sons
Heat Transfer Enhancement in Microchannel Heat Sink Using Nanofluids.