Journal of Thermal Science and Engineering Applications

Guest Editorial

Special Issue: Advances in Nanofluids: Modeling and Applications (ANMA)

Heat transfer enhancement in heat-exchange devices is one of the key factors affecting energy savings and compact designs in wide variety of engineering applications. Pioneering heat transfer research has been carried out leading to the development of a new innovative energy enhancement technique through the addition of nanoparticles (usually less than 100 nm) to low thermal conductivity conventional fluids. Fluids with suspended nanoparticles are called "nanofluids." The suspended metallic or nonmetallic nanoparticles change the transport properties and heat transfer characteristics of the base fluid by a significant extent. Metallic nanofluids often refer to those containing metallic nanoparticles (such as Cu, Al, Zn, Ni, Si, Fe, Ti, Au, and Ag), while nanofluids containing nonmetallic nanoparticles such as aluminum oxide (Al_2O_3), copper oxide (CuO), and silicon carbide (SiC, ZnO, TiO_2) are often considered as nonmetallic nanofluids. Nanofluids exhibit superior heat transfer properties compared to conventional heat transfer fluids. Recently, the idea of using hybrid nanofluids by suspending dissimilar nanoparticles has been investigated for further improvement of the heat transfer and pressure drop characteristics by employing a trade-off between the advantages and disadvantages of individual suspension (attributed to good aspect ratios), better thermal networks, and the synergistic effects of nanomaterials.

The conventional direct absorption solar collector system uses a well-established technology that has been employed in a variety of applications. However, the efficiency of this type of collector is limited by the absorption properties of the working fluid. The solar collector technology in combination with the technology associated with emerging nanofluids is considered as a promising combined technology. Reviews on the topic suggest significant potential enhancements in the efficiency and performance of solar thermal systems, solar water heaters, thermal energy storage systems, solar cells, and solar stills. Despite the touted importance of this concept, a very limited number of research papers in the area of solar collectors augmented with nanofluids has been published in the literature. In general, research on nanofluids is still considered in its early-to-moderate stages and much more is needed in terms of developing new models for experimentally verified nanofluids and in demonstrating the viability of these fluids in key areas such as biomedicine and cancer treatment, renewable and nuclear energy, automotive lubrication, electronics cooling, heat exchangers, energy conversion and storage, and many other areas.

This special issue was initiated to focus on the latest advances in nanofluids research and to address their utilization and application in various engineering and technological systems. Many papers were submitted, but only 22 were accepted. The contributions to this special issue addressed various pertinent aspects of nanofluids in terms of their models and applications. The accepted papers ranged from reporting on theoretical and numerical investigations to reporting on experimental investigations. The topical coverage included heat transfer enhancement using nanofluids; nanofluid mixed convection in cavities and porous media; magnetohydrodynamic flows of nanofluids; double spirally coiled tube heat exchangers employing nanofluids; application of hybrid nanofluids in TPCT and cubical cavities with active walls; synthesis of WO_3/liquid paraffin nanofluids; melting of nanophase-change materials inside an open cell metal foam; solidification of phase-change material nanocomposites; application of ferrofluids in solar photovoltaic systems; application of pseudo-plastic nanofluids and/or olive leaf synthesized nanofluids in solar collectors; use of nanofluid coolants in radiators; use of bearing nanofluids in axial piston pumps; stability analysis of cross diffusion of Waters B fluids in saturated permeable nanofluids and nanofluid flows; and heat transfer in the presence of various effects such as homogenous–heterogeneous chemical reactions, gyrotactic microorganisms, and magnetohydrodynamics.

The Guest Editors of this issue would like to express their deep appreciation and thanks to the Editor-in-Chief, Professor S.A. Sherif for his diligent efforts and unique editorial skills and to the staff of the ASME *Journal of Thermal Science and Engineering Applications*, and in particular Jennifer L. Smith who was instrumental in ensuring that this issue is published on time and Beth Darchi who has been unfailing in helping with issues pertaining to the Journal Tool throughout the whole process. Special thanks are also due to the various talented authors for their excellent original contributions and to the anonymous professional reviewers for their valuable time, comments, and suggestions which significantly improved the quality of the accepted papers.

It is important to note here that while this special issue could not possibly cover all aspects and areas of nanofluids research and applications, it is hoped that it succeeded in providing a review of recent advances in specific fields and problems in nanofluids. It is also hoped that this issue succeeded in providing motivation to researchers to fully engage in this important and emerging research area.

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