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PREFACE

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Preface

We had organized and held four highly successful conferences on Porous Media and its applications in Science, Engineering and Industry in 1996 in Kona, Hawaii, in 2007 in Kauai, Hawaii in 2010 in Montecatini, Italy, and in 2012 in at Potsdam, Germany which were attended by various researchers in porous media worldwide. This conference will build on the last four conferences so that it reflects the research done internationally in the currently active areas of the topic. The presence of the highly successful Journal of Porous Media and both editions of the very well received Handbook of Porous Media as well as Special Topics and Reviews in Porous Media-An International Journal acted as an additional impetus to further galvanize this conference. Papers of high quality will be considered for submission to the Journal of Porous Media or the Special Topics and Reviews in Porous Media-An International Journal. The Fifth International Conference on Porous Media and its Applications in Science, Engineering and Industry was sponsored by Engineering Conferences International and National Science Foundation, which was held from June 22-27, 2014 at Kona, Hawaii.

This preface is an update of the one for the proceedings of the Fourth International Conference on Porous Media and its Applications in Science, Engineering and Industry. The pioneering works in the area of fluid transport as well as some aspects of heat transport in porous media go back to the beginning of last century. Convective heat transfer in fluid-saturated porous media has gained considerable attention in recent decades due to its relevance in a wide range of applications such as thermal insulation engineering, water movements in geothermal reservoirs, heat pipes, underground spreading of chemical waste, nuclear waste repository, geothermal engineering, grain storage and enhanced recovery of petroleum reservoirs. Radiative heat transfer and multiphase transport processes in porous media, both with and without phase change, have gained extensive attention in recent years. This is due to the wide range of applicability of these research areas in contemporary technology. These applications include, but are not restricted to, areas such as geothermal engineering, building thermal insulation, chemical catalytic reactors, packed cryogenic microsphere insulation,

petroleum reservoirs, direct contact heat exchangers, coal combustors, nuclear waste repositories, and heat pipe technology.

Several applications related to porous media require a detailed analysis of convective heat transfer in different geometrical shapes, orientations and configurations. Based on the specific applications, the flow in the porous medium may be internal or external. Most of the studies in porous media carried out until the past two decades are based on the Darcy flow model, which in turn is based on the assumption of creeping flow through an infinitely extended uniform medium. However, it is now generally recognized that non-Darcian effects are quite important for certain applications. Different models have been introduced for studying and accounting for such non-Darcian effects as the inertial, boundary, and variable porosity effects. The ultimate goal of studies in convective heat transfer in porous media is to determine the dimensionless heat transfer coefficient, the Nusselt number. A considerable amount of research has been carried out to accomplish this, and empirical correlations for the Nusselt number for a variety of configurations and boundary conditions have been established, with certain limitation, of a wide variety of current technological applications. Many industrial operations in the areas of chemical and metallurgical engineering involve the passage of a fluid stream through a packed bed of particulate solids to obtain extended solid fluid interfacial areas or good fluid mixing. Typical examples of applications involving such systems include catalytic and chromatographic reactions, packed absorption and distillation towers, ion exchange columns, packed filters, pebble-type heat exchanger, petroleum reservoirs, geothermal operations and many others. The design of these systems is decided by mechanisms of pressure drop, fluid flow and heat and mass transfer governing the process in the packed bed arrangement. Considerable attention has been paid to the aforementioned aspects because of their direct influence on the optimization and stability of the design of these systems. Developments in modeling transport phenomena in porous media have advanced several pertinent areas, such as biology. As such this conference also included papers related to bio transport in porous media.

This special proceedings of the Fourth International Conference on Porous Media focuses on the recent works in Porous Media and its Applications in Science, Engineering and Industry. Research works related to porous media have been the subject of various studies due to the wide range of applicability of these research areas in contemporary technology, such as electronics cooling, biological, heat pipes, packed bed heat exchangers, drying technology, catalytic reactors, tissue engineering, drug delivery, environmental engineering, thermal insulation engineering, nuclear waste repository, spreading of chemical waste, enhanced recovery of petroleum reservoirs and grain storage. This special proceedings addresses a number of pertinent topics in porous media related to natural and forced convection, material processing applications, industrial and environmental heat transfer and flow, experimental and measuring techniques, biotransport, heat and mass transport, particle transport and deformable porous bodies, advances in numerical techniques and mathematical approaches.

The topics that were presented in this conference are summarized below:

Topic 1: Natural and forced convection in porous media

The multi-commodity heat hump dryer

Lorcelie B. Taclan

Sensitivity analysis of effective thermal conductivity of open-cell ceramic foams using a simplified model based on detailed structure

Miguel Mendes, TU Bergakademie Freiberg

Thermal properties of highly porous fibrous ceramics

Jingjing Sun, Aerospace Research Institute of Materials and Processing Technology, Beijing

DROPLET IMPACT AND PENETRATION ON SERIES OF PARALLEL TUBES

Nasser Ashgriz, UNIVERSITY OF TORONTO

Mixed convection in horizontal channels heated below with external heat losses on upper plate and partially filled with aluminum foam

Oronzio Manca, Dipartimento di Ingegneria Industriale e dell'Informazione, Seconda Università degli Studi di Napoli

Mixed convection in a channel with an open cavity filled with porous media in local thermal non-equilibrium

Oronzio Manca, Dipartimento di Ingegneria Industriale e dell'Informazione, Seconda Università degli Studi di Napoli

On the velocity distribution in a microscopic porous medium

Maciej Matyka, University of Wrocław

Miscible density driven convective mass transfer process analysis based on Entransy dissipation theory

Rui-Na Xu, Tsinghua University

Topic 2: Material processing applications

Fabrication and microstructural characterization of silica aerogel by aging additional pressurization

Xiaoyan Wang, Aerospace Research Institute of Material and Processing Technology, Beijing

The preparation and properties of novel structural carbon foams derived from different mesophase pitches

Liqiong Yu, Aerospace Research Institute of Materials and Processing Technology, Beijing

Effect of helium-3 formation on the thermal decomposition of uranium tritide particle beds

Ryan Keedy, Sandia National Laboratories

On the influences of the thermal boundary condition at porous-fluid interface upon the Nusselt number in a pipe partially filled by a porous material

Nader Karimi, University of Glasgow

Topic 3: Industrial and environmental heat transfer and flow in porous media

An investigation of porous inserts in electronic cooling

Fatemeh Tavakkoli, University of California, Riverside

Improved permeability prediction for heterogeneous porous media by bundle-of-leaky-tubes with cross-flow model

Faruk Civan, The University of Oklahoma

Fate and transport of nanohybrids in subsurface media for oil field applications

Ben Shiau, The University of Oklahoma

Porous structures used as flameproof pressure relief elements a novel approach of flameless venting

Julia Hornig, Physikalisch-Technische Bundesanstalt (PTB)

Effective solid-to-fluid heat transfer coefficient in EGS reservoirs

Xiao-Long Ouyang, Tsinghua University

Particles migrating and plugging mechanism in loosen sandstone heavy oil reservoir and the strategy of production with moderate sanding

Yiting Xie, State Key Laboratory of Oil and Gas Reservoir Geology and Exploitation

Use of liquid pressure-pulse decay permeameter in experimental evaluation of permeability in wellbore cement under geopressured geothermal conditions

Mileva Radonjic, Louisiana State University

Numerical Solution of Burgers' equation arising in Longitudinal Dispersion Phenomena in Fluid Flow through Porous Media by Crank-Nicolson Scheme

Ravindara Borana

Evaporation from a capillary tube: Experiment and modelization

Emmanuel Keita, Université Paris-Est, Laboratoire Navier

Steady MHD flow of a Sisko fluid past a porous plate

Shirley Abelman, University of the Witwatersrand, Johannesburg

Experimental study for air cooling using membrane covered tray

Mohamed Ali, King Saud University

Topic 4: Experimental and measuring techniques

Experimental analysis of air vortex impingement through porous screens

Fatemeh Hassanipour, University of Texas at Dallas

Experimental evaluation of wellbore cement- formation shear bond strength in presence of drilling fluid contamination

Mileva Radonjic, Louisiana State University

Effect of temperature dependent viscosity on natural convective boundary layer flow over a horizontal plate embedded in a nanofluid saturated porous medium

Shobha Bagai, University of Delhi

Thermohydraulics of Porous Heat Exchangers: Full or Partial Blockage?

Kamel Hooman

Quantification of effect of convergence in porous media flow

Srinivas Pasupuleti, Indian School of Mines

Topic 5: Bio transport in porous media

Pore scale modeling of the microbially induced CaCO₃ precipitation process

Robin Gerlach, Montana State University

Concentration of bioethanol and dehydration of organic solvents by porous membranes

Tadashi Uragami, Kansai University

A model for magnetic drug targeting in a permeable microvessel with spherical porous carrier particles

Precious Sibanda, University of KwaZulu-Natal

Multilayer minichannel heat sinks: The effect of porosity scaling on pressure drop

Fatemeh Hassanipour, University of Texas at Dallas

Numerical simulation of pressure pulse decay experiment on crushed low permeability rocks considering Klinkenberg effect and gas absorption/desorption

Bo Zhou, Tsinghua University

FLUID FLOWS THROUGH UNSATURATED POROUS MEDIA: AN ALTERNATIVE SIMULATION PROCEDURE

Maria Martins-Costa

Experimental study of water retention properties of a high performance concrete with small sliced samples

Qier Wu, Université Lille Nord de France, France

Topic 6: Combined heat and mass transfer in porous media

Theoretical investigation of the influences of thermal boundary conditions upon the heat transfer characteristics in a channel partially filled by a porous material

Nader Karimi, University of Glasgow

HYDRA: Macroscopic modeling of hybrid ablative thermal protection system

Gregory Pinaud, Airbus Defense and Space

Phase change with local thermal non-equilibrium in a two-phase mixture model

Franz Lindner, Universität der Bundeswehr München

Effect of variable porosity on composite heat transfer in a boundary layer flow

Nagaraju Puttabasavsetty, Vijaya College

The use of expandable casing technology as a new remediation tool for micro-annular gas migration

Mileva Radonjic, Louisiana State University

Three dimensional heat and mass transfer in capillary evaporator

Laetitia Mottet, Institut de Mécanique des Fluides de Toulouse

Influence of thermal radiation from solid phase upon the local thermal non-equilibrium condition in a porous medium

Nader Karimi, University of Glasgow

Heat flow from a buried cylindrical tank partially submerged in groundwater

Robert McKibbin, Massey University

Investigation of transpiration cooling with local thermal non-equilibrium model: Effects of different thermal boundary conditions at the porous-fluid interface

Zheng Huang, Tsinghua University

Topic 7: Particle transport and deformable porous bodies

Studies on permeability properties and particle capture efficiencies of porous sic ceramics processed by oxide bonding technique

Atanu Dey, Central Glass & Ceramic Research Institute

MRI evidence of nanoparticles migration in drying porous media

Emmanuel Keita, Université Paris-Est, Laboratoire Navier

Fractional diffusion model for transport through porous media

Nadeem Malik, King Fahd University of Petroleum and Minerals

Topic 8: Advances in Numerical Techniques

Performance comparison of the finite-difference, practical-finite-analytic, differential quadrature, and differential-cubature methods for solving porous media immiscible fluids transport

Faruk Civan, University of Oklahoma

Effects of non-Darcy flow and pore proximity on gas condensate production from nanopore unconventional resources

Jeffrey Callard, University of Oklahoma

Transport in groundwater aquifers: Simplifying models using natural stratigraphy

Robert McKibbin, Massey University

Analysis of the transport in the resting mammary glands

Ana Quezada, University of California, Riverside

CO₂ migration in the geological formation

Shujuan Wang, University of California, Riverside

Modified Rhie-Chow / PISO algorithm for collocated variable finite porous media flow solvers

Markus Nordlund, Philip Morris Products SA

Turbulence in porous media: Some fundamental questions addressed by DNS solutions

Marc-Florian Uth, Hamburg University of Technology

Wall thickness optimization of a transpiration-cooled sharp leading edge at atmospheric re-entry

Christian Dittert, German Aerospace Center

Numerical solutions of non-linear fractional transport models in unconventional hydrocarbon reservoirs using variational iteration method

Nadeem Malik, King Fahd University of Petroleum and Minerals

Comparison of volume-average simulation and pore-scale simulation of thermal radiation and natural convection in high temperature packed beds

Rui-Na Xu, Tsinghua University

Onset of double diffusive reaction-convection in an anisotropic porous layer with internal heat source

Sravan Nayeka Gaikwad, Gulbarga University

Topic 9: Advanced mathematical approaches to the modeling of porous media

Effective permeability upscaling from heterogenous to homogenous porous media

Mehmet Cicek, University of Oklahoma

Research of particles migrating mechanism in loosen sandstone reservoir and the strategy of moderate sanding

Zhaohui Chen, SWPU

Pressure transient characteristics of multi-stage fractured horizontal wells in shale gas reservoirs with consideration of multiple mechanisms

Jingjing Guo, Southwest Petroleum University, China

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