Proceedings of CHT-17
ICHMT International Symposium on Advances in Computational Heat Transfer

May 28-June 1, 2017, Napoli, Italy

CHT-17-132

SIMULATION OF LAMINAR CONVECTION FLOW OF AL_2O_3-WATER NANOFLUID IN AN ASYMMETRIC HEATED CHANNEL

Vincenzo Bianco[*,§], Federico Scarpa[*] and Luca A. Tagliafico[*]
[*]DIME-TEC, University of Genoa, Italy
[§]Correspondence author. Email: vincenzo.bianco@unige.it

ABSTRACT The present paper proposes a two dimensional analysis of the laminar convection flow of water-Al_2O_3 nanofluid inside a rectangular section channel with non-symmetric boundary conditions. In particular, a constant heat flux is applied on the top surface of the channel and an adiabatic condition on the bottom one. This situation is typical of many devices, such as solar collector, which receives thermal radiation from the top surface with objective to heat a working fluid, water-Al_2O_3 in the present case, and which are insulated on the bottom one in order to limit energy waste.
Numerical simulations are developed by using the commercial software COMSOL, which employs finite element methods approach to solve the conservation equations, moreover thermal dependent properties are considered in the simulations The analysis is conducted for Re numbers ranging between 500-1000, concentration between 0%-6% and dimension of particles between 20-60 nm.
An increase of Nu is observed at the increase of the concentration, as well as a substantial increment of the pressure losses.

REFERENCES

Bianco, V., Manca, O., Nardini, S. and Vafai, K. [2015], *Heat Transfer Enhancement in Nanofluids*, CRC Press, Boca Raton, Florida.
Corcione, M. [2011], Empirical correlating equations for predicting the effective thermal conductivity and dynamic viscosity of nanofluids, *Energy Conversion and Management*, vol. 52, pp 789-793.
Corcione, M. [2012], A semi-empirical model for predicting the effective dynamic viscosity of nanoparticle suspensions, *Heat Transfer Engineering*, vol. 33, pp 575-583.
Das, S.K., Choi, S.U.S., Yu, W., Pradeep, T. [2008], *Nanofluids science and technology*, John Wiley&Sons, Hoboken, New Jersey.
Khanafer, K., Vafai, K. [2011], A critical synthesis of thermophysical characteristics of nanofluids, *International Journal of Heat and Mass Transfer*, vol. 54, pp 4410-4428.
Utomo, A.T., Haghighi, E.B., Zavareh, A.I.T., Ghanbarpourgeravi, M., Poth H., Khodabandeh, R., Palm, B., Pacek, A.W. [2014], The effect of nanoparticles on laminar heat transfer in a horizontal tube, *International Journal of Heat and Mass Transfer*, vol. 69, pp 77-91.
Zhao, N., Yang, J., Li, H., Zhang, Z., Li, S. [2016], Numerical investigations of laminar heat transfer and flow performance of Al_2O_3–water nanofluids in a flat tube, *International Journal of Heat and Mass Transfer*, vol. 92, pp 268–282.