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Particle Flow Through a Hydrophobic Nanopore

Friday, 4 June 2021 15:30 (15 minutes)

Sparked by the interest in hydrophobic membranes for use in membrane distillation for the purification of water by means of thermally driven transport of water from impure liquid phase to a purified vapour phase, we provide the beginnings of an analytical model for the full range of transport coefficients for gas flow through porous media where the solid phase interacts with the fluid by a repulsive force. We focus here on the transport properties of a hydrophobic nanopore of cylindrical geometry. A model for a more general porous medium may then be given as a statistical distribution of such pores. While Knudsen diffusion of rarefied gases in small cylindrical pores, isothermal as well as non-isothermal, is a well-studied phenomenon, we provide an analytical model to assess the effect of a repulsive interaction between the gas particles and the pore walls. Isothermal transport of rarefied gases has seen some recent advances in this direction [1], as well as the non-isothermal case for slip flow [2]. We provide here clear physical interpretations of the effects of the repulsive interaction on the non-isothermal transport of gas through a pore, and discuss how this knowledge can be applied to the design of porous materials optimized for a particular purpose.

Time Block Preference

Time Block A (09:00-12:00 CET)

References

[1] Bhatia el at. Molecular transport in nanopores: a theoretical perspective. Phys. Chem. Chem. Phys., 2011, 13, 15350-15383.
[2] K. Proesmans and D. Frenkel. Comparing theory and simulation for thermo-osmosis. J. Chem. Phys., 151:124109, 2019.

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