Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Numerical Investigation of Conjugate Heat Transfer in a Channel with a Growing Deposit Layer HONGYING LI, IHPC A*STAR, YIT-FATT YAP, The Petroleum Institute, Abu Dhabi, United Arab Emirates, JING LOU, IHPC A*STAR, JOHN CHAI, The Petroleum Institute, Abu Dhabi, United Arab Emirates — The working fluid carries particles flowing in channels is widely encountered in many engineering applications such as oil and gas pipes and heat exchangers. These particles have a tendency to deposit onto the wall of the channels, form a deposit layer. This additional growing and increasingly thicker deposit layer, normally is of a lower thermal conductivity. In the system with heat transfer involved, such deposit layer introduces extra thermal resistance and consequently leads to the lower the heat transfer performance of the system. Besides, the deposit layer reduces flow cross sectional area of the channel and directly responsible for inducing a larger pressure drop. As such, a good understanding of the conjugate heat transfer coupling the evolving deposit layer and fluid flow is important. This numerical study is undertaken to fill in some of the gaps in this respect. Here, we consider conjugate heat transfer in a channel with a deposit layer gradually growing on the wall. The problem is governed by conservation equations for mass, momentum, species and energy, coupled with the appropriate interfacial condition at the depositing front separating the fluid from the deposit. This is a moving boundary problem as the front evolves over time. The depositing front is captured using the level-set method in this study. Numerical solution is performed on a fixed mesh using the finite volume method. A detailed parametric study quantifying the effect of the growing deposit layer on the heat transfer performance is performed.

Hongying Li
Institute of High Performance Computing,
Agency for Science, Technology and Research

Date submitted: 01 Aug 2013 Electronic form version 1.4