Accepted Manuscript

Flow-resistance analysis of nano-confined fluids inspired from liquid nano-lubrication: A Review

Xianzhu Huang, Jian Wu, Yudan Zhu, Yumeng Zhang, Xin Feng, Xiaohua Lu

PII: S1004-9541(16)31162-4
DOI: doi:10.1016/j.cjche.2017.05.005
Reference: CJCHE 826

To appear in:

Received date: 2 November 2016
Revised date: 14 May 2017
Accepted date: 14 May 2017

Please cite this article as: Xianzhu Huang, Jian Wu, Yudan Zhu, Yumeng Zhang, Xin Feng, Xiaohua Lu, Flow-resistance analysis of nano-confined fluids inspired from liquid nano-lubrication: A Review, (2017), doi:10.1016/j.cjche.2017.05.005

Flow-resistance Analysis of Nano-confined Fluids Inspired from Liquid Nano-lubrication: A Review*

Xianzhu Huang[1], Jian Wu[1,2], Yudan Zhu[1,**], Yumeng Zhang[1], Xin Feng[1] , Xiaohua Lu[1,**]

[1]College of Chemical Engineering, State Key Laboratory of Materials-Oriented Chemical Engineering, Nanjing Tech University, Nanjing 210009, China

[2]Division of Machine Elements, Luleå University of Technology, 97187, Luleå, Sweden

Abstract How to reduce flow resistance of nano-confined fluids to achieve a high flux is a new challenge for modern chemical engineering applications, such as membrane separation and nanofluidic devices. Traditional models are inapplicable to explain the significant differences in the flow resistance of different liquid-solid systems. On the other hand, friction reduction in liquid nano-lubrication has received considerable attention during the past decades. Both fields are exposed to a common scientific issue regarding friction reduction during liquid-solid relative motion at nanoscale. A promising approach to control the flow resistance of nano-confined fluids is to reference the factors affecting liquid nano-lubrication. In this review, two concepts of the friction coefficient derived from fluid flow and tribology were discussed to reveal their intrinsic relations. Recent progress on low or ultra-low friction coefficients in liquid nano-lubrication was summarized based on two situations. Finally, a new strategy was introduced to study the friction coefficient based on analyzing the intermolecular interactions through atomic force microscope (AFM), which is a cutting-point to build a new model to study flow-resistance at nanoscale.

Keywords flow resistance, membrane separation, liquid nano-lubrication, model, intermolecular interactions, AFM

---

*Supported by the National Science Foundation of China (21176112, 21576130, 21490584, 51005123), Qing Lan Project, the State Key Laboratory of Materials-Oriented Chemical Engineering (KL15-03), Specialized Research Fund for the Doctoral Program of Higher Education (20133221110001) and Jiangsu Natural Science Foundation (BK20130062).

** Corresponding author. E-mail: ydzhu@njtech.edu.cn(Y. D. Zhu), xhlu@njtech.edu.cn (X. H. Lu).