



## **The mathematical model of wax deposition thickness in the pipeline taking into account the aging of the deposits**

**Olga Strizhenko<sup>a</sup> and Danila Sergeev<sup>b</sup>**

Department of Computational Physics, Physical Faculty, St.Petersburg State University,  
Ulyanovskaya street 3, Petrodvorets, St.Petersburg 198504, Russia

**e-mail:** <sup>a</sup> bzixilu@gmail.com, <sup>b</sup> danila.sergeev@gmail.com

### **Abstract.**

One of the most common problems in the heavy oil production involves the formation of paraffin wax deposits in pipelines. The inner surface of the pipeline becomes fouled with these paraffin deposits, which reduces the flow diameter, decreases overall through-out, and results in a higher pressure drop when oil is pumped through the pipeline. The deposits within the pipelines decrease the capacity of the duct and cause pipelines breaking. Wax deposition is a serious problem of oil production in the petroleum industry. Therefore, accurate prediction of this solid deposition problem can result in increasing the efficiency and safety of oil production. The authors consider the problem of wax deposition in pipelines and the growth model of paraffin deposits in pipelines which is based on the model developed in the Michigan University. The model describes deposits growth time dependence based on molecular diffusion. This model also includes the aging of the deposits that is a process of increasing of the wax fraction in the deposit due to the internal diffusion. This research is intended to be a part of the project dealing with the development of the flow simulator. The discussed model is to be integrated in the VSS (Ventilation System Simulator).

**Keywords:** wax deposition, simulation, pipelines, wax ageing, wax thickness, oil modeling, computational methods

**MSC numbers:** 76R50,76R99

## References

- [1] S. Mokhatab and B. Towler. *Wax prevention and remediation in sub-sea pipelines and flowlines*. World Oil Online Magazine Article(IA) 2009 <http://www.worldoil.com>
- [2] L. F. A. Azevedo, and A. M. Teixeira. *A Critical Review of the Modeling of Wax Deposition Mechanisms*. Petroleum Science and Technology, 2003, pp. 393 - 408
- [3] E.D. Burger, T.K. Perkins, and J.H. Striegler. *Studies of Wax Deposition in the Trans Alaska Pipeline*. JPT, 1981 (June), pp. 1075 - 1086
- [4] J.J.C. Hsu and M.M. Santamaria. *Wax Deposition of Waxy Live Crudes Under Turbulent Flow Conditions*. In: Proceedings of the SPE 69th Annual Technical Conference and Exhibition, Paper 28480, 1994, 25 - 28 September, New Orleans, Louisiana, Society for Petroleum Engineers, TX
- [5] Zhenyu Huang. *Application of the fundamentals of heat and mass transfer to the investigation of wax deposition in subsea pipelines*, University of Michigan. PhD thesis, 2011, University of Michigan, Ann Arbor
- [6] K. Rosvold *Wax deposition models*. Norwegian University of Science and Technology, Master Thesis, June 2008 <http://MasterThesis>
- [7] P. Singh, R. Venkatesan, H. S. Fogler, and N. R. Nagarajan. *Formation and aging of incipient thin film wax-oil gels*. AIChE J. 2000, **46**, Issue 5, pp. 1059 - 1074
- [8] O. Strizhenko. *Helium flow distribution problem on example of exhaust channel simulation*. In: Proceedings of the International Conference-School for Young Scientists "Modern Problems of Applied Mathematics & Computer Science", August 2012, Dubna, Russia, pp. 226 - 229 <http://www.google.ru/AMCS>