

Results of wax deposition under different thermal flux conditions

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Development of large offshore fields is often limited due to the expense of transporting oil in insulated tiebacks. One possible technology to overcome this limitation is cold flow, where solids are first brought out of solution, and the slurry is transported over long distances. The technology can be effective only if there is no significant solid deposition over long distances. The slurry can potentially be cooled to near sea water temperatures, thus greatly reducing thermal flux which is considered primarily responsible for wax deposition. In this paper, we present results of deposition in two different flow loops, with a number of different model oils, and at different thermal flux and flow conditions.

Several different model oils were used in the study. Minerals oils were mixed with different weight percent waxes to adjust the range and distribution of normal paraffins in model oils. The oils prepared thus had different wax appearance temperatures, pour points and viscosities. Two flow loops were used in the study – a flow loop consisting of clear pipes for

visualization and a stainless pipe in pipe heat exchanger that afforded excellent temperature control. Baseline experiments under conditions where thermal flux existed confirmed significant deposition steadily increasing with time. The rate of deposition and the total decreased when the wall shear stress increased. A number of experiments with low to zero heat fluxes showed that the deposition is considerably less under cold flow conditions, but is not zero. This deposition also decreases and is often eliminated at higher wall shear stresses. A particle image velocimetry (PIV) system was used in conjunction with the clear pipe loop to confirm deposition and estimate deposit thickness. An inline particle analysis system was used to image particle size distribution and wax particle morphology.

References

- [1] Merino-Garcia, D., and Corraera, S. (2008). Cold Flow: A Review of a technology to Avoid Wax Deposition, *Pet. Sci. Tech.*, 26: 446-459

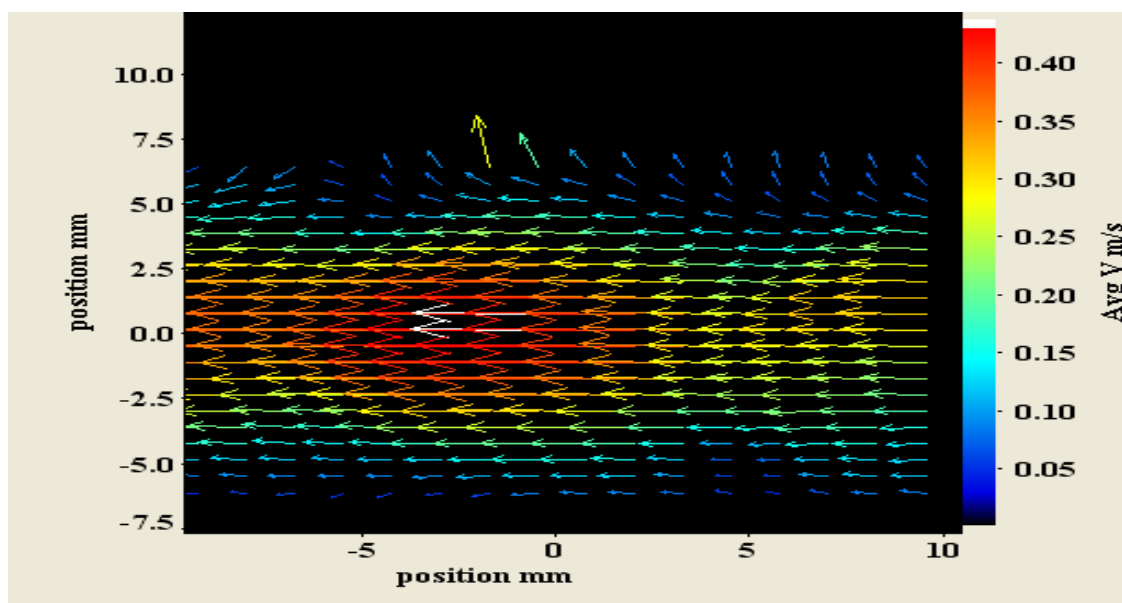


Figure 1: Velocity profiles using the PIV showing small wall depositions