Multiphase flow in the *Rock&Roll* Ring-Flowloop

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Problems of multiphase flow are the concern of many scientists from different spheres. In Oil&Gas industry, the issue of transportability of the multiphase flow system within offshore pipelines is one of key problems. Presence of hydrocarbon gases and connate water or intentionally injected water in the collectors, accompanied by harsh pressure and temperature conditions brings to the formation of crystalline ice like particles called hydrates. Hydrates tend to agglomerate, stick and finally plug the pipelines. So far the traditional solutions for this problem involved usage of different types of hydrate inhibitors in order to prevent hydrate formation, whereas the alternative solution lies in accepting the risk of hydrate formation and studying the ways to manage it. Hydrate formation evaluation and control strategies require solid understanding of the coupling between hydrodynamics and thermodynamics of the multiphase flow and kinetics of the hydrate formation. In particular, the interplay between multiphase flow morphology and hydrate formation is of great interest. In order to better understand the processes and consequently to produce an adequate model, reliable experimental studies are required.

The aim of this work is to conduct an experimental study on gas-liquid flow patterns in an in-house made Ring flowloop called Rock&Roll. The Rock&Roll flowloop is a unique apparatus the pipe is installed on a disk that is sequentially inclined by an axis in 4 positions (Figure 1a), to induce the motion of the fluid, inside the ring-tube, similarly to a rocking cell. Two parameters drive the torus: the inclination angle and the rotation speed. The absence of pump enables undisturbed flow, while the endless test section affords flow to become fully developed. The first experimental investigations enabled to establish the experimental protocol and study the air-water two-phase flow patterns (Figure 1b) in the torus by varying liquid loading, diameter of the tube and rotation speed of the torus. On the base of qualitative observations, a flow regime map was produced.

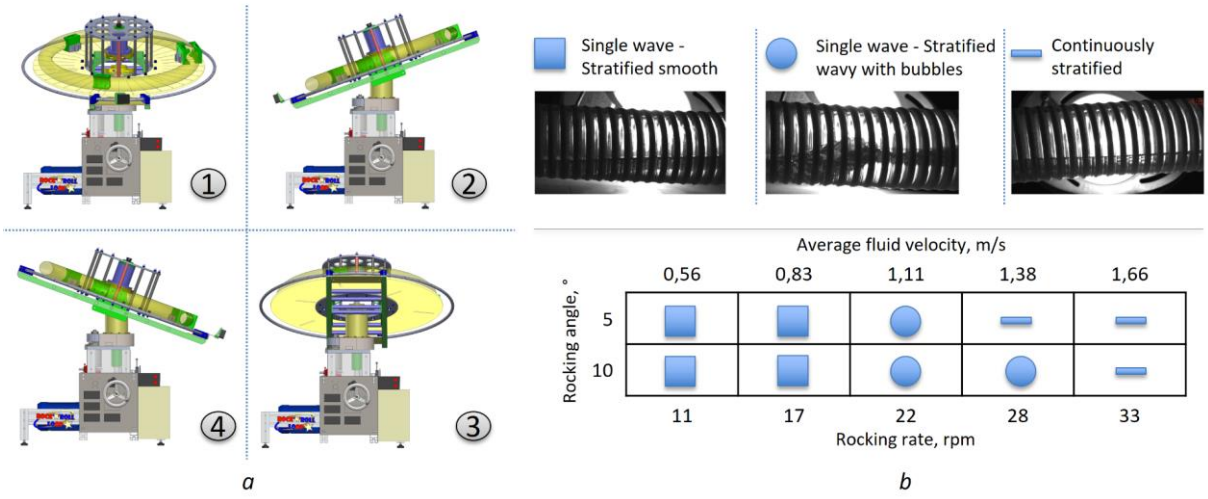

Figure 1. (a) 3D model of Rock&Roll Loop inclined in 4 positions and (b) Observed air-water two-phase flow patterns

References

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