

HYSIFLO

An IFP Joint Industry Project

Hydrate transport in oil-dominant flows

Objective

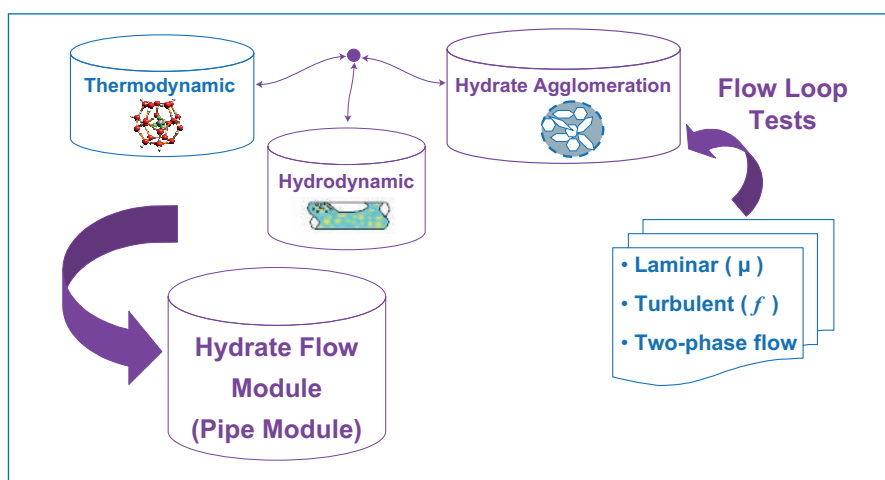
The objective of this JIP is to develop a Hydrate Flow Module allowing operators to:

- evaluate the flow properties when transportation is in the hydrate domain;
- predict the risk of blockage in oil production systems.

Industrial concern

The risk of hydrate formation causing blockages in production lines remains today one of the main concerns in deepwater field development. As a result, a hydrate control strategy may be a major part of the design, resulting in high capital and operational expenditures.

A promising alternative technique would be to allow hydrates to form, but in a controlled way, in order to transport dispersed slurries in the flow line. This could be achieved by taking advantage of the intrinsic ability of some crude oils to form stable water-in-oil emulsions and to transport hydrate particles as dispersed slurry. It could also



To evaluate the flow properties in case the transportation is operated in the hydrate domain and the risk of blockage.

be achieved by adding anti-agglomerant additives to condensate or non-dispersive crude oils.

Program

What is the Hysiflo project expected to deliver?

This JIP is aimed at delivering a prototype predictive tool that will make it easy for process engineers to evaluate flow properties and the risk of blockage when

transportation of the produced fluid in pipelines is in the hydrate domain.

This predictive tool is named the Hydrate Flow Module.

What is the Hydrate Flow Module?

The Hydrate Flow Module will be delivered as a Cape-Open software program including calls to thermodynamics software and hydrodynamic and hydrates

IFP is a world-class public-sector research and training center, aimed at developing the technologies and materials of the future in fields of energy, transport and the environment.



The Lyre loop high-tech tool to assess the risk of hydrate or wax formation under real conditions.

agglomeration modules, needed to model the mixture flow through a whole pipe. Effort will be focused on developing the hydrate agglomeration module and the hydrodynamic closure laws and their links with other laws.

Key features for success

The project has a strong background: the Hydrate Flow Module will be based on a physical model that was recently validated in the IFP Lyre loop for laminar and liquid flow conditions.

The project is based on IFP's broad expertise and powerful tools: in addition to IFP's broad and deep expertise in all scientific areas related to the hydrate issues (thermodynamics, fluid mechanics,

physical chemistry, etc.) and its leadership in the investigation of hydrates agglomeration in oil-dominated systems, this project will derive full benefit from the use of a unique industrial-scale facility (the Lyre flow loop) and from the deployment of an associated experimental methodology that incorporates improvements made over more than ten years. Moreover, significant experimental efforts have been made in recent years to get useful new information from the Lyre loop tests (such as real time visualization through in situ video, particle size distribution in the flow line thanks to an FBRM probe). These new measurements bring very valuable insights to the problem.

The project is based on a **theoretical and experimental approach:** complementing the theoretical and numerical development of the Hydrate Flow Module by itself, a series of loop tests will be carried out in order to:

- extend model application to turbulent and multiphase flow conditions;
- validate the Hydrate Flow Module by simulating tests in the loop.

Deliverables

The main deliverables of this program will be:

- Hydrate Flow Module (Cape-Open prototype software);
- experimental database;
- full program research report (closure laws).

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