STUDY OF SULFUR SOLUBILITY IN SUPERCRITICAL CH_4

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Scientific context:

Natural gas flows in **transport network** with an average pressure of 5 MPa. Then the gas is **expanded** to 0.5 MPa before entering the distribution network. For several years now, **solids deposits** formations just behind the gas expander **have been reported** [1-3].

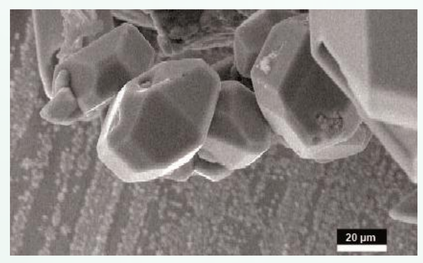
The solid has been identified as **elemental sulfur** and its **behavior** is now **understood** thanks to a **modeling tool** [4].

In order to **prevent** the apparition of **solid sulfur deposits** causing security and maintenance **problems** it is imperative to **determine sulfur solubility** in natural gas at transport conditions of pressure and temperature [5-7].

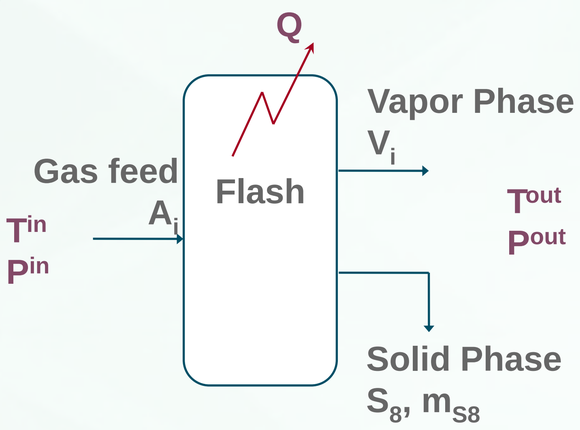
The **aim** of our study is to develop a **laboratory scale pilot** able to **quantify sulfur solubility** in natural gas at **transport conditions**

Gas expansion Facility

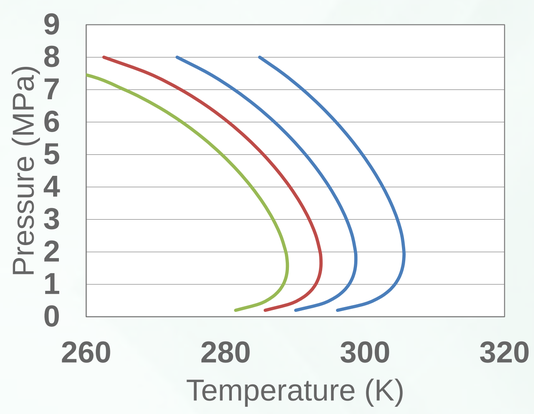
S8 deposit



SEM observed S8



Reactive flash diagram



Calculated isosolubility curves

Modelisation:

To **eliminate** solid sulfur deposition it is necessary to **understand** the deposit **mechanism**. 2 hypothesis have been made: **Condensate** and **desublimation**.

Both hypothesis have been studied thanks to **a reactive flash model** [4]. Its constitutives equations are classically the chemical and physical **equilibriums** as well as partial mass and energy **balances**.

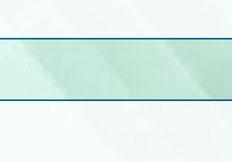
Desublimation appears to be the most **plausible mechanism** explaining the formation of a sulfur deposit. Indeed **pressure** reduction implies **temperature reduction**, which reinforces solid formation.

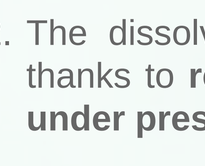
Experimental pilot:

The experimental pilot **principle** can be resumed following **3 steps**:

1. An equilibrium cell provides gas **saturation**. Its particularity is to keep constant the gas pressure while the gas is flowed out.
2. The dissolved sulfur is **trapped** in 3 separators placed in series thanks to **reactive absorption** solutions. The first absorption occurs **under pressure** while the 2 other take place at atmospheric pressure
3. At last, sample of the trapping solution are taken and **analysed** by **Gas chromatography** to determine **sulfur solubility**.

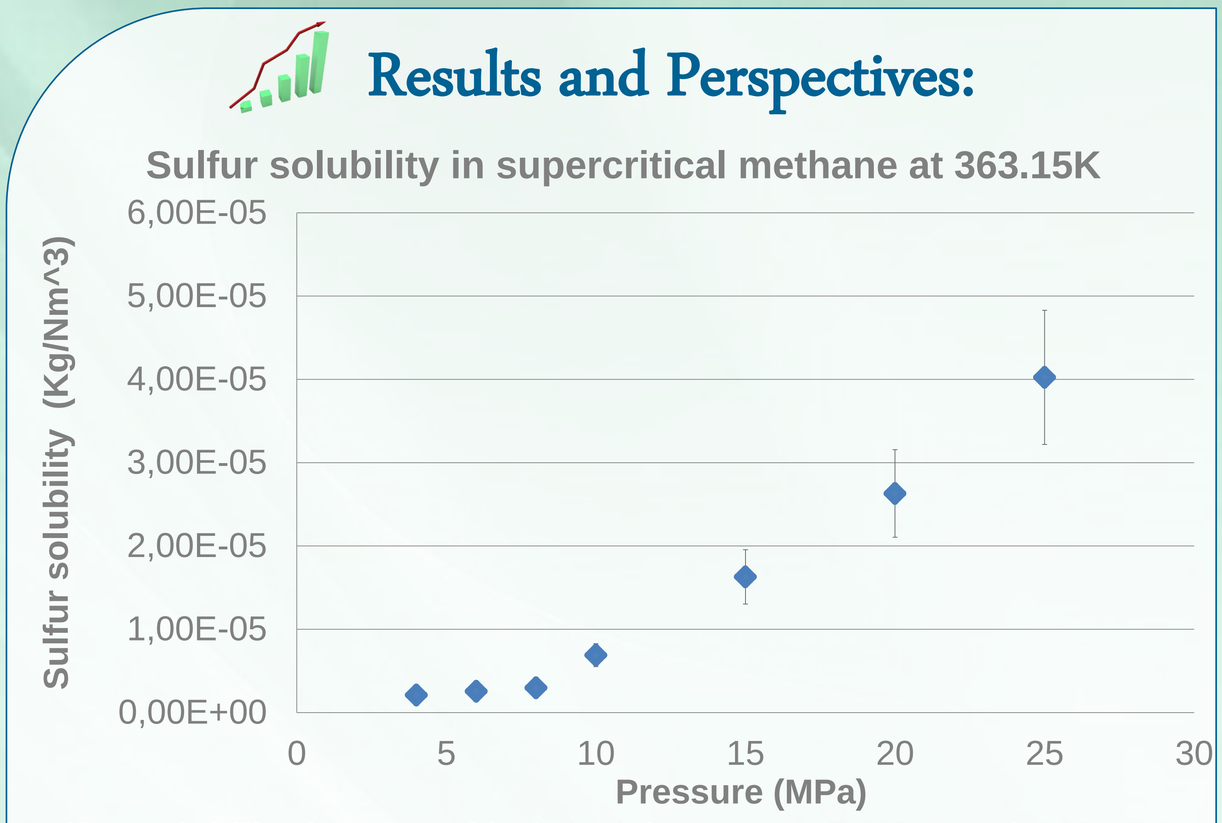
Gas chromatography





Experimental pilot

Results and Perspectives:



Sulfur solubility in supercritical CH4 from 4 to 25 MPa, and 363.15K have been **measured** with the new experimental **device we developed**.

Our new experimental device presents several **advantages** such as **variable volume** equilibrium cell and under pressure **reactive absorption** trapping, which allows us to quantify **smaller** amount of sulfur.

Then, we are able to **measure sulfur solubility** in ranges of pressure, temperature and gas composition **not studied yet**, especially at **transport conditions**.

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