Research Topic for the ParisTech/CSC PhD Program

Subfield: Chemical Engineering

ParisTech School: Mines ParisTech

Title:**Thermodynamic aspects of transport of CO2: phase equilibrium and transport** properties

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Short description of possible research topics for a PhD:
The context of the study is twofold: In the CCS context, CO_2 is generally capture from power plant and must be transport to the location of storage or valorization. The CO_2rich stream contains a lot of impurities like CO, NOx, Sox, Ar, N_2, etc.. These impurities have a non-negligible impact on the phase diagram and modify the classical condition of transportation (modification of densities, bubble and dew pressure, etc..).
Also, many new natural gas reservoirs contain important quantities of acid gases. These acid gases are mainly composed of CO_2, H_2S and other sulphur components like methyl-mercaptans. After acid gases absorption using chemical absorption process, the acid gases removed from natural gas contains also some impurities like aliphatic hydrocarbons and aromatics. Acid gas injection involves compressing the blend of acid gas and hydrocarbons commonly produced during sour gas sweetening.
Acid-gas injection operations constitute a commercial-scale analogue for CO_2 geological sequestration in sedimentary basins.

Scientific objectives

The first one concerns the complete determination of phase diagrams including acid gases, NOx, SO_2, and other hydrocarbons. This point is very important for the determination of PT envelop essential for the design of compressor. Density measurementsare also expected. The second objective is the development of thermodynamic models allowing the treatment of the measured data (literature or new one) and prediction of phase diagrams. The last objective concerns the determination of transport properties (viscosities) and heat capacities in order to test the developed models.

Required background of the student:
Thermodynamics of fluids, experimental work, oil and gas engineering, chemical engineering

A list of 5(max.) representative publications of the group:
-M. Nazeri, A. Chapoy, A. Valtz, C. Coquelet, B. Tohidi, 2017, Fluid Phase Equilibria, 454, 64-77
-C Coquelet, P Stringari, M Hajiw, A Gonzalez, L Pereira, M Nazeri, R.Burgass, A. Chapoy, 2017, Energy Procedia 114, 6844-6859
-A. Gonzalez Perez, A.Valtz, C.Coquelet, P.Paricaud and A.Chapoy, 2016, Fluid Phase Equilibria, 427, 371–383
-M. Hajiw, A. Chapoy, C. Coquelet, 2015, Can. J. Chem. Eng. 93 (2), 432-442
-A. Chapoy, C. Coquelet, H. Liu, A. Valtz, B. Tohidi, 2013, Fluid Phase Equilibria, 356, 223-228.