

## Thermodynamic Study of Ternary Systems {CO<sub>2</sub>-Amine-Water} for CO<sub>2</sub> Capture Process

Karine Ballerat-Busserolles  
*University Blaise Pascal, FRE 3099 CNRS/UBP, Aubière, France*

Laurence Rodier  
*University Blaise Pascal, Aubière, France*

Mougin Pascal  
*Institut Français du Pétrole, Rueil Malmaison, France*

Jean-Yves Coxam<sup>C, S</sup>  
*University Blaise Pascal, FRE 3099 CNRS/UBP, Aubière, France*

The carbon dioxide released in the atmosphere is responsible for the so-called greenhouse effect, leading to global warming. According to the Kyoto protocol the emission of greenhouse and acid gases, resulting from fossil fuels combustion, or present as constituents of natural gas, must be reduced. Different national and international research projects have emerged and the present work is a thermodynamic study carried out in the frame work of the ANR CapCO<sub>2</sub> (French National Research Agency) on the capture of CO<sub>2</sub> in post-combustion processes. Our objective is to obtain reliable thermodynamic data for different amines in order to correlate CO<sub>2</sub> capture properties and the amine structure. More specifically enthalpies of solution and gas solubilities in aqueous solutions of selected amines are determined simultaneously to solution density and amine dissociation constants. This work is the continuation and the extension of a study concerning more classical alkanolamines in aqueous solutions [1]. The enthalpies of solution are directly measured by flow calorimetric technique at temperatures 323 K and 373 K and pressures up to 2 MPa. The gas solubilities in the amine solutions are deduced from the analysis of the enthalpic data. A customized flow mixing unit adapted to a SETARAM C-80 calorimeter [2] is used to measure the enthalpy of solution of CO<sub>2</sub> in aqueous solutions of amine. Experiments are carried out at constant temperature and pressure for different gas loadings up to the saturation of the solvent. The dissociation constants are determined at atmospheric pressure and temperatures between 298 K and 333 K using an automatic titrator from Mettler-Toledo equipped with a glass electrode. This study will allow a classification of amines regarding their efficiency to capture CO<sub>2</sub>. The results will be compared to a reference system {CO<sub>2</sub>- MonoEthanolAmine-water}.

[1] H. Arcis, L. Rodier, K. Ballerat-Busserolles, J-Y. Coxam, Calcon08, Jersey City, NJ, USA.

[2] H. Arcis, L. Rodier, J.-Y. Coxam, *J. Chem. Thermodyn.* 39 (2007), 878-887.