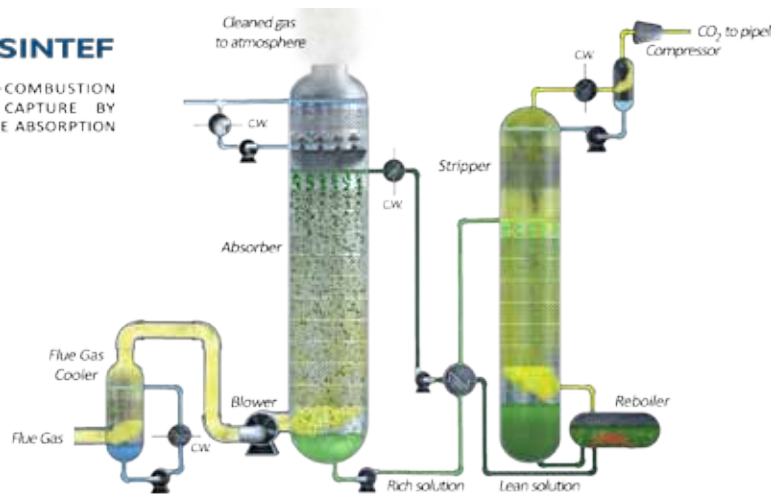


Post-combustion CO₂ capture

August 2010

SINTEF
POST-COMBUSTION
CO₂ CAPTURE BY
AMINE ABSORPTION



Regenerable processes for capture and recovery of CO₂ and other acid gases have been studied as a co-operation between the Department of Chemical Engineering, NTNU, SINTEF Materials and Chemistry, The Research Council of Norway and Norwegian and foreign industry partners. Two large sources for CO₂ effluent are from power industry (coal and gas) and the steel industry. At present we collaborate with a number of European partners through the European Unions Sixth Framework Program in two large European projects aiming at capture the CO₂ from effluent gases and store it safely into underground geological layers. Laboratory facilities

upon technical and economic considerations. These project(s) will then enter a Pilot Phase that will last another 5 years to finally confirm the technical and economic viability of the project(s).

ULCOS - Ultra Low CO₂ Steelmaking

The ULCOS project within EU 6th Framework Program involves steelmakers, plant manufacturers, raw materials suppliers and private and university laboratories. During the first phase, lasting five years and with a budget of 40 million euros, nine project teams will study a broad spectrum of potential solutions ranging from evolution of the blast furnace to direct electrolysis of iron ore, not forgetting the possibilities offered by alternative energies such as biomass.

SINTEF Materials and Chemistry is involved in two of the subprojects:

- 1) The capture and storage subproject where we will investigate the applicability of amine scrubbing and membrane processes for capture of CO₂ from blast furnace gases.
- 2) Electrolytic steel production

At the end of the first phase the most appropriate project(s) will be selected for further evaluation based

CASTOR - CO₂ from Capture to Storage

CASTOR is a 16 million Euro project within the EU 6th Framework Program and involves 30 partners (industries, research institutes and universities) coming from 11 different European countries.



The main targets of CASTOR are:

- A reduction in post-combustion capture costs, from €Euro 50-60 € down to Euro 20-30 € per ton of CO₂
- To advance general acceptance of the overall concept in terms of storage performance (capacity, CO₂ residence time), storage security and environmental acceptability.
- To start the development of an integrated strategy connecting capture, transport and storage options for Europe.

SINTEF Materials and Chemistry is together with NTNU involved in the largest subproject dealing of CO₂ post combustion capture with absorbents. Our main activities are:

- Propose and investigate new chemicals (mainly amines) for improved CO₂ absorption.
- Provide thermodynamic and kinetic data for improved calculation models
- Improved process optimisation and integration with power plants.

The processes are based on chemical absorption followed by regeneration of rich absorption liquid. Basic research on solvent formulas combined with process modeling and simulation provide basis for optimal design. Important solvent properties related to process performance include absorption kinetics, chemical stability, non-toxicity, low cost, low volatility and acceptable regeneration energy requirement.



Laboratory facilities

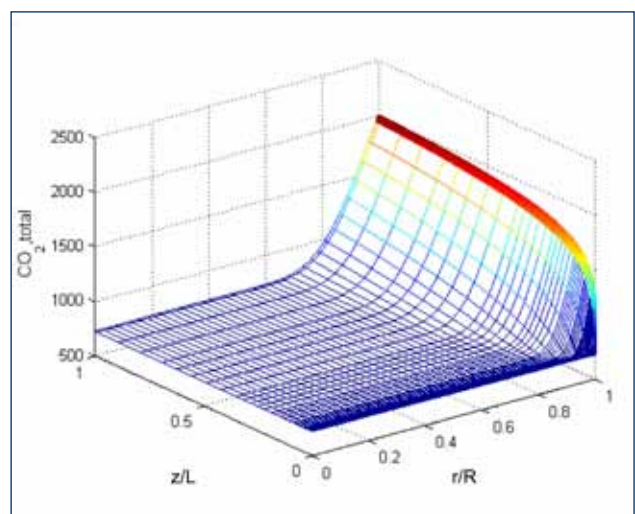
Projects for our customers are carried out in the laboratory scale as well as in larger scale equipment. Gas/liquid equilibrium data are fundamental in all absorption and can be measured at maximum 150°C and 20 bar. Picture 1 shows the equipment to determine gas/liquid equilibrium data at maximum 130°C. The gas phase is circulated in a closed loop through a pre-loaded solvent and further through a continuous gas analyzer.

Optimization and development of new or existing processes are main activities within most R&D-areas at SINTEF Materials and Chemistry. Picture 2 shows a pilot plant for determination of key parameters (mass transfer, energy requirement etc.) for absorption processes with conventional columns or membrane contactors.

Modeling and simulation

Modeling and simulation of gas absorption processes are performed using commercial and in-house software. Our in-house modeling tools incorporate rigorous thermodynamic models and rate-based mass-transfer models and follow the same concepts as for multiphase reactors.

These models are an indispensable tool for the characterization and optimization of absorption and desorption tower performance. Our modeling and laboratory work is closely related, and the experimental data is used for model validation and tuning. Picture 3 shows a 3d concentration profile of absorbed CO₂ being transported into the bulk of liquid.



SINTEF Materials and Chemistry
box 4760 Sluppen, NO-7465 Trondheim, Norway
Phone: + 47 40 00 37 30, www.sintef.no/materials_chem

CONTACT

Thor Mejdell
Phone: +47 98 24 34 87
thor.mejdell@sintef.no