TNO Science and Industry

Process Industry
Schoemakerstraat 97
P.O. Box 6005
2600 JA Delft
The Netherlands

www.tno.nl

T +31 15 269 69 00
F +31 15 262 07 66
info-IenT@tno.nl

TNO report

CAPRICE-D2-4 (EU-contract: 038974)

PP/PE membrane contactors for CO2

Date	2008.11.04
Author(s)	Johannes de Bruin
Assignor	Earl Goetheer, Jan Hopman
Project number	EC-contract: 038794 (TNO-033.13825)
Classification report	Confidential
Title	
Abstract	
Report text	
Appendices	
Number of pages	18 (incl. appendices)
Number of appendices	1

Summary

One of the main advantages of the use of membrane contactors in CO_2 absorption from flue gasses is that besides operational aspects also thermodynamical aspects can be applied to optimize to CO_2 capture process. In order to realize the benefits of using membrane contactors, a proper selection of the membrane has to be made. Operational aspects that are to be considered are stability (for example: critical entry or breakthrough pressure and chemical and thermal stability), commercial availability, costs and environmental impact. On the other hand, an important thermodynamical aspect is the mass transfer performance of the membrane.

To realize the potential of membrane contactors, a first selection based on the commercial availability of hydrophobic membranes has been made. The main focus is to use relatively cheap polymeric material. The polyolefins polypropylene and polyethylene are compared with PTFE type material. Of importance to note is that the membranes tested will hardly contribute to the overall resistance in a CO_2 membrane gas absorption process.

It seems that the commercial availability of flat sheet membranes is much better, as compared to the availability of hollow fiber membranes. As another selection criteria, different membranes have been tested in terms of non absorptive flue gas tests to study the sensitivity to condensation in the membrane modules or in de gas passage pipe lines. A large amount of condensed water vapour can cause a decrease in the gas flow rates and an increase in the pressure drop over the modules. From the results obtained from the non absorptive flue gas tests it can be concluded that flat sheet membrane modules are less sensitive to condensation and pollution, as compared to hollow fiber modules

Different hydrophobic commercial available flat sheet membranes were selected. The membranes were tested for their critical entry pressure and mass transfer performance. One membrane, which showed good performance for both performances, was chosen to be used for scaling up. Compared to a single A4 membrane sheet a twentyfold bigger multilayer membrane module leads to a small decrease of the overall mass transfer of the module, this is caused by less optimal flow characteristics inside the modules. Nevertheless the specific surface area is higher, as a result of the fact that the membrane could be build more compactly.

Membrane gas absorption modules offer low investments costs, are easy to upscale and does have long term stability, therefore MGA modules does have a high potential as alternatives for traditional packed column absorbers.

The rest of this document is project confidential.