

**TNO report**



**Caprice-D2-5 (EC contract 038974)**

**Desorption Membrane test report**

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Project number	033.13825
Classification report	
Title	
Abstract	
Report text	
Appendices	
Number of pages	28 (incl. appendices)
Number of appendices	3

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## Public Summary

This work has been done in the framework of the project “CO<sub>2</sub> Capture using amine processes: International cooperation and exchange” (acronym “CAPRICE”; Sixth Framework Program). The main goal of this project is the development of alternative technique for post-combustion CO<sub>2</sub>-capture based on amine processes and further implementation of these technologies on a large scale. This report is focused on the development of the novel membranes for Membrane Gas Desorption (MGD) processes at temperatures typical of stripper conditions (100-120 °C) and, then, testing of this novel membrane in MGD process with two different absorption liquids, Mono-ethanol-amine (MEA) and CORAL<sup>®</sup>.

Potential membranes for MGD process have to be mechanically and chemically stable in relevant absorption liquids at operated temperature (100-120 °C). The potential membranes should have zero flux for absorption liquids, on the one hand, and high permeability of CO<sub>2</sub> and low permeability of water vapour, on the other hand. To meet these demands the potential membrane materials should be in glassy state at operated conditions. Based on the results of an analysis of the Database «Transport properties of membrane gas separation materials» (TIPS) and the measurements of the strain strength and elongation at break after long contact with boiling water, five potential glassy polymers were selected. These polymers were indentified as novel potential membrane materials for MGD process at temperatures typical used as stripper conditions.(100-120 °C) and having high CO<sub>2</sub> permeability coefficients and glass transition temperatures above or in vicinity of 150 °C.

Testing of the selected membrane materials and available typical porous support at MGD conditions (100 °C, 20% MEA aqueous solution) showed that all membrane materials were stable, however, the support was destroyed after several hours. Thus, the flat sheet PVTMS asymmetric membrane was selected for further investigations. It was shown that PVTMS membranes have good mechanical stability after the exposure to MEA at 110 °C during 250 hours. No leakage of MEA aqueous solutions through PVTMS membranes was observed.

Short-term MGD testing (7-8 days) of PVTMS-membranes with MEA solutions revealed that CO<sub>2</sub> transport decreased by almost a factor of 2. In contrast to MEA solutions, the performance of the PVTMS/CORAL<sup>®</sup> MGD-system was stable at operated temperature of 103 °C.

It was experimentally demonstrated that the dense selective layer (200 nm) of the PVTMS membrane provided a significant decrease of water vapour permeation at high temperatures, as compared to traditional membrane gas-liquid contactors (e.g. based on PTFE).

The rest of this document is project confidential.