INNOVATIVE CONTACTOR FOR CO_2 RECOVERY

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Abstract

CO2 capture from pre- or post-combustion is still a challenging way to control greenhouse gas emissions. Among other processes, the membrane processes would be very appealing as soon as the separation performances will reach economical threshold because the main conventional capture drawback could vanish, e.g. the high energy consumption or VOCs emissions. In particular the hollow fibre contactors involving gas/liquid absorption are very promising. Indeed with contactors, a hydrophobic membrane acts as a semi-permeable barrier between a gas and a liquid, each of them having tangential fluxes to the membrane surface without any mixing. Note that here the selectivity is not provided by the membrane but by the absorbent liquid.

Long term utilisation of contactors needs polymers resistant to absorbent liquids. Membrane characteristics like hydrophobicity, mechanical resistance and permeability must remain constant within a long period of time.

Along with this context, we have proposed several polymers to fabricate new contactors for CO_2 capture by chemical and physical absorption. The stability of selected polymers and hollow fibres (HF) were checked with two solvents: monoethanolamine (MEA, aqueous solution 50% wt) for chemical absorption and Genosorb 1753® for physical absorption.

The characterization of virgin and tested HF was made by SEM, mechanical tests and pure water permeability. Temperature cycles allowed us to accelerate the aging by the absorbent liquids. The results have shown that some of the tested polymers were susceptible to be damaged by MEA and Genosorb 1753®. The more stable polymers were selected to continue the tests. To improve the resistance of contactors, we decided to develop composite HF, even more resistant to absorbent liquids, keeping in mind the cost of the contactor and the effectiveness of the absorption. This approach was successful and improved hydrophobic membranes could be prepared with almost null pure water permeability under the operating conditions. SEM views revealed a quasi-homogeneous surface (Figure 1c).

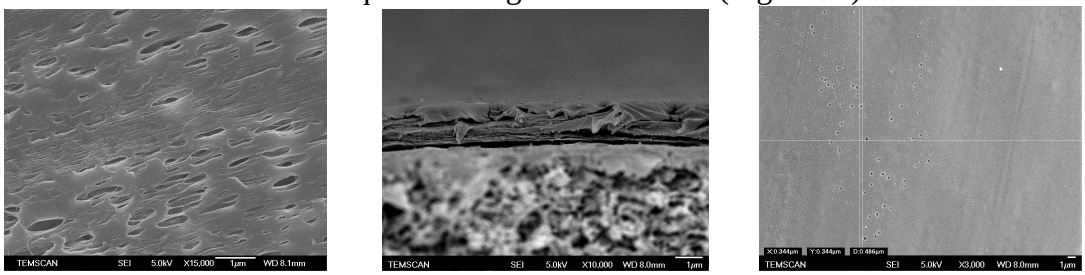

Figure 1 (a) virgin HF, (b) composite HF, (c) surface of the composite.

Modules with 210 hollow fibers were fabricated and tested on a pilot equipment. Absorption of CO_2 increased with liquid flow, high MEA concentrations and concentration of CO_2 on gas stream. Absorption up to 100% was obtained with 15% of concentration of CO_2. Regeneration of absorbent liquid was successfully tested at 70°C.