ADVANCED MEMBRANE OPERATIONS IN CO_2 CAPTURE

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Membrane-based gas separation systems are today widely accepted and, in many cases, used as a unit operation for generation, separation and purification of gases in gas, chemical, petroleum and allied industries. There are several applications of membrane gas separation and several membrane materials and membrane modules solutions available today for the various fields of interest.
CO_2 separation from flue gas coming out from a power plant or a cement industry, as well as CO_2 from biogas and natural gas is one of these fields. Polymeric membranes, thermally rearranged polymer membranes, mixed matrix membranes, etc. are some examples of membranes investigated c/o the ITM-CNR for separating gases, such as, CO_2, CH_4, etc. of interest for many industrial cycles. The mass transport properties of these membranes were analyzed feeding gas streams, with different content of water vapor and other aggressive components; these being one of the crucial assets for moving towards to real applications [1,2]. Other aspects, such as aging owing to water vapor, physical compaction, thermal cycles and contaminants were and are currently under investigation, also with long term characterizations [3]. To this purpose, together with material science, membrane engineering covers a fundamental role in the development of this technology and its scale-up. Modelling assists experimental analysis for a unified approach in advanced membrane unit operations. In this logic, a tool was developed in terms of performance maps suitable for analyzing also membrane-integrated systems identifying proper operating conditions and proposing possible process schemes for achieving the desired targets for the various streams of interest [4,5].
Among the main results achieved, there are the mass transport characterization of membranes, membrane properties restoring after long-time operation, modelling of the membrane gas separation as unit operation and its inclusion in more complex production cycles.

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