

## **Membrane Technology for Hydrogen Separation in Ethylene Plants**

A. A. Al-Rabiah

Department of Chemical Engineering, King Saud University, P. O. Box 800, Riyadh 11421, Saudi Arabia, email: [arabiah@ksu.edu.sa](mailto:arabiah@ksu.edu.sa)

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The use of membranes for hydrogen separation has been applied commercially in recent years. Several new membrane materials, which are now commercially available, are seriously being considered for the separation of hydrogen both effectively and efficiently within the ethylene process. This study investigates the feasibility of hydrogen separation from the cracked gas in an optimal manner before entering the low-temperature section of the ethylene plant. This separation would consequently reduce the refrigeration load as well as the equipment size of the cold-box section. Polyimide membrane materials are very selective for hydrogen transport as compared to other hydrocarbons, such as methane and ethylene. Polysulfone has also proven to be selective for the separation of hydrogen from hydrocarbons. This study evaluates two new commercial polyimide membranes as well as a new polysulfone membrane and determines the feasibility of hydrogen separation before entering the low-temperature section. The performance of the membranes and their effects on the overall ethylene process are also investigated. An innovative scheme for the separation of hydrogen in the ethylene plant using a two-stage membrane system with recycling is presented. For this scheme, the cracked gas volume in the retentate stream is decreased by about 18% compared to the conventional process. A comparison of the refrigeration requirements between the conventional ethylene process and the modified process with the membrane-based hydrogen separation system is presented. This study has evaluated the new membrane separation scheme for a new grass-roots ethylene plant as well as for an existing plant.