

## TECHNOLOGY OFFER: MEMBRANE BASED PROPANE DEHYDROGENATION PROCESS FOR PROPYLENE PRODUCTION

### OVERVIEW

**Category:** Membrane , Catalyst , Reactor , Process , R&D knowledge , Other

**Benefit summary:** The novel developed process aims to perform the production of propylene by propane selective dehydrogenation under milder operating conditions than the traditional ones. Accordingly the lower operating temperature would result in less catalyst deactivation by coke. The catalyst regeneration system would be in principle eliminated.

**Development status:** First prototype under construction, operation in May 2015

**IP status:** Two patent applications filed

### NOVELTY

- Technology benefit description:** The novel developed process aims to introduce the concept of membrane separation in the process of production of propylene by propane selective dehydrogenation. The shift of chemical equilibrium enabled by the presence of a membrane for hydrogen separation would allow the possibility to operate under milder operating conditions than the traditional commercialized processes. Accordingly the lower operating temperature would result in less catalyst deactivation by coke. The catalyst regeneration system would be in principle eliminated. The possibility to perform a scale down of 1/5 in capacity of the traditional plants for olefins production thus becomes a reality. The novel process is based on a “hybrid architecture” concept where a combination of catalytic reactors, membrane separators and membrane integrated catalytic reactors is performed (Figure 1). The proposed scheme is characterized by high flexibility, since the membrane integrated reactor could in principle also be replaced by a non-integrated reactor, according to the commonly known “open architecture”.

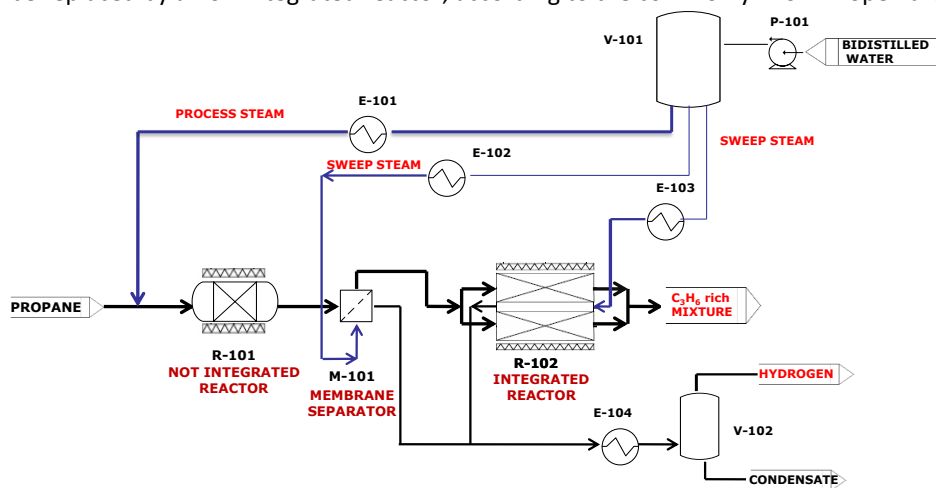


Figure 1. Membrane based propane dehydrogenation – hybrid configuration process scheme

- Technology uniqueness and comparison vs state-of-the-art:** The proposed “hybrid architecture” scheme is not yet disclosed in the state of the art.

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This project has received funding from the European Union’s Seventh Framework Programme for research, technological development and demonstration under grant agreement no 263007.

## DEVELOPMENT

- ▶ **Technology Readiness Level:** TRL 1 ; 2 ; 3 ; 4 ; 5 ; 6 ; 7 ; 8 ; 9
- ▶ **Development status:** First prototype under construction/operation in May 2015

## INTELLECTUAL PROPERTY

Patent / application N°	Title	Countries	Status	Priority date
EP15157764.0	System and method for the production of alkenes by the dehydrogenation of alkanes	Europe		5 March 2015
EP Application 11160218.1	Method for olefins production	Europe + other Countries	PCT Application	29 March 2011

## TECHNOLOGY PROVIDER

- ▶ **Technology provided by:** Stamicarbon b.v. acting under the name MT Innovation Center via KT – Kinetics Technology S.p.A.
- ▶ **Related expertise:** Experience in: (i) process and detailed design for the chemical, petrochemical and refining plants, (ii) novel process schemes development, (iii) membrane reactor technology for process intensification.

## TECHNICAL DETAILS

- ▶ **Description:** The novel process scheme is developed in order to operate the two reactors at temperatures of 500°C or lower, depending on the threshold temperature of the catalyst. The operating pressure for the time being is set at a maximum of 5 bara. The operation under pressure is essential to achieve a sustainable hydrogen flow across the membrane. In Figure 2 the dehydrogenation reactor of the prototype phase is reported.

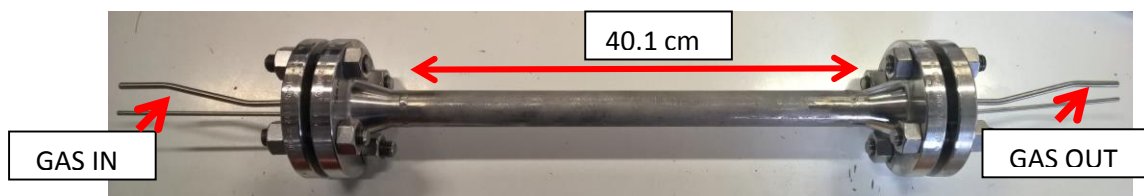


Figure 2. Propane dehydrogenation reactor for prototype plant

The main technological limit of such process is the membrane deactivation under propylene exposure. This would limit the operating temperature at value compatible with membrane lifetime.

## LICENSING

- ▶ **Collaboration type sought:** Application of membrane concept in olefins production complex. We seek collaboration to assess the feasibility of the concept on pilot/semi industrial level.
- ▶ **Support provided:** Expertise in membrane manufacturing and catalyst development

## CONTACT DETAILS

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