

# METHANOL STEAM REFORMING IN THE TRADITIONAL AND MEMBRANE REACTORS OVER Pt-Rh/TiO<sub>2</sub>-In<sub>2</sub>O<sub>3</sub> CATALYST USING SURFACE-TREATED Pd-Cu FOIL MEMBRANES

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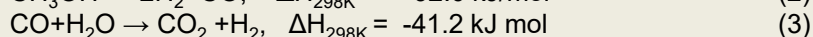
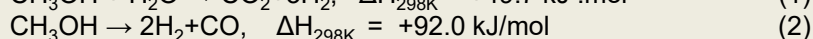
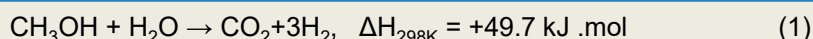
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## Introduction / Objectives / Aims

During the last decade hydrogen is considered as one of the most promising energy sources. The development of hydrogen energy and the fuel cells will become in the nearest future the main fields of hydrogen application. The fermentation products such as, methanol, ethanol and some others can be considered as the most perspective raw materials. The study of methanol steam reforming (MSR) in catalytic membrane reactors with the use of membranes based on palladium alloys attracts a great interest last decade because of the possibility of manufacture of ultra pure hydrogen from accessible and renewable sources.

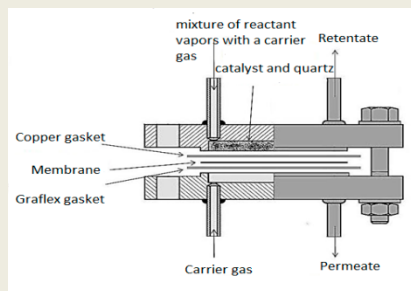
The basic  
MSR  
reactions



The aim of the study was the development of membrane catalytic process for high-purity hydrogen production using palladium-copper membrane with a surface treated by various methods in the presence of Pt-Rh/TiO<sub>2</sub>-In<sub>2</sub>O<sub>3</sub> catalyst

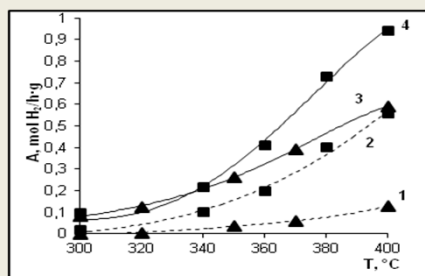
## Methods

### Membrane reactor with foil of Pd-Ru alloy

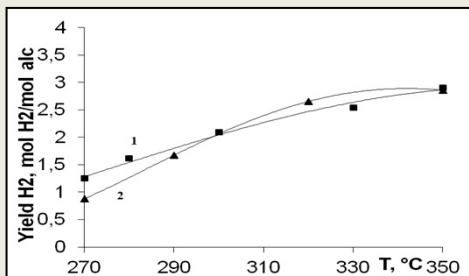


The catalyst (Pt-Rh/TiO<sub>2</sub>-In<sub>2</sub>O<sub>3</sub>) was prepared by sequential reduction of metal precursors (hexachloroplatinic acid and rhodium III chloride) at room temperature in the liquid phase using 0.5 M NaBH<sub>4</sub> as a reducing agent.

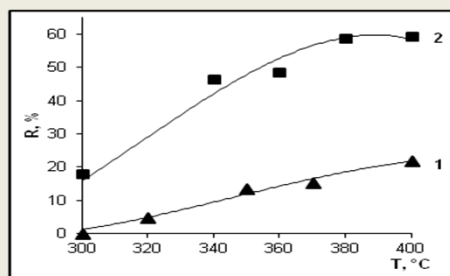
## Results



Temperature dependence of H<sub>2</sub> yields for membrane: 1, 3 – after ultra sonic cleaning and photonic treatment; 2, 4 – after deformation ordering. Solid line – total hydrogen yield; dotted line – hydrogen yield in the permeate zone



Comparison of hydrogen yields in traditional (1) and membrane (2) reactors



The hydrogen recovery degree in the permeate zone for membrane: 1 – after ultrasonic cleaning and photonic treatment; 2 – after deformation ordering

## Conclusions

The methanol steam reforming process on the membrane-catalytic systems using PdCu foil membranes with a surface treated by various methods was studied. The highest hydrogen permeability and hydrogen yield was achieved with the use of a membrane-catalytic system Pt-Rh/TiO<sub>2</sub>-In<sub>2</sub>O<sub>3</sub> catalyst and Pd-Cu membrane after deformation ordering. In this case, the hydrogen recovery degree on the permeate zone reached 60%.