



# A STUDY OF OSMOSIS RATE THROUGH SEVERAL PROTON CONDUCTING POLYMER COMPOSITE MEMBRANES



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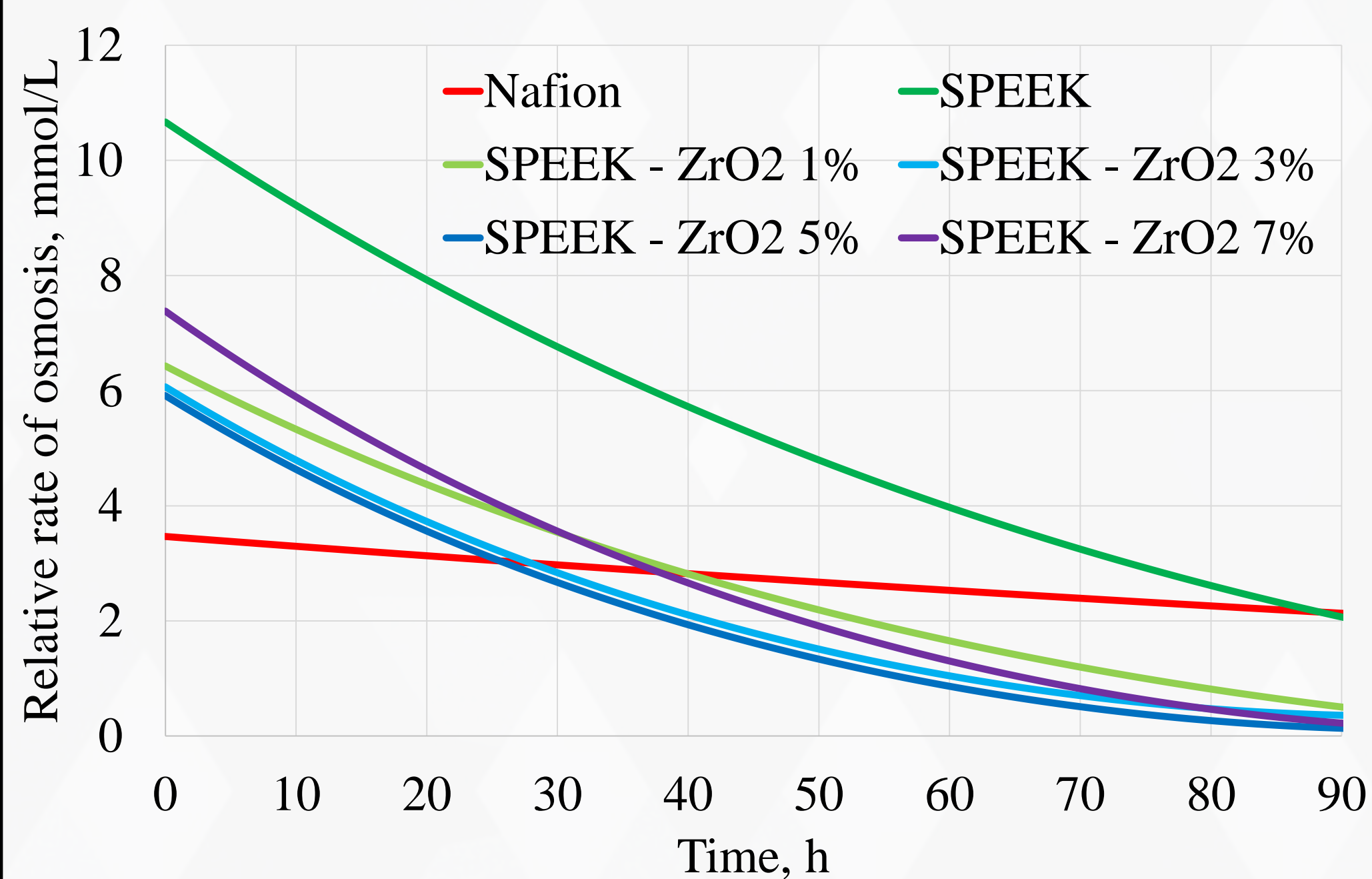
## Introduction

Carbon dioxide is usually a useless by-product of various industrial processes that should not be released into the environment due to its nature as a harmful greenhouse gas. One of the more promising ways of disposing of it in an economical and environmentally friendly way is by using it as a raw material for electrochemical synthesis reactors. An important part of such reactors is the ion exchange membrane. In this study the influence of ZrO<sub>2</sub> content in SPEEK – ZrO<sub>2</sub> composite membranes on rate of osmosis through them was investigated, with the goal of evaluating ZrO<sub>2</sub> as an additive for making ion exchange membranes with fine-tuned osmotic permeability.

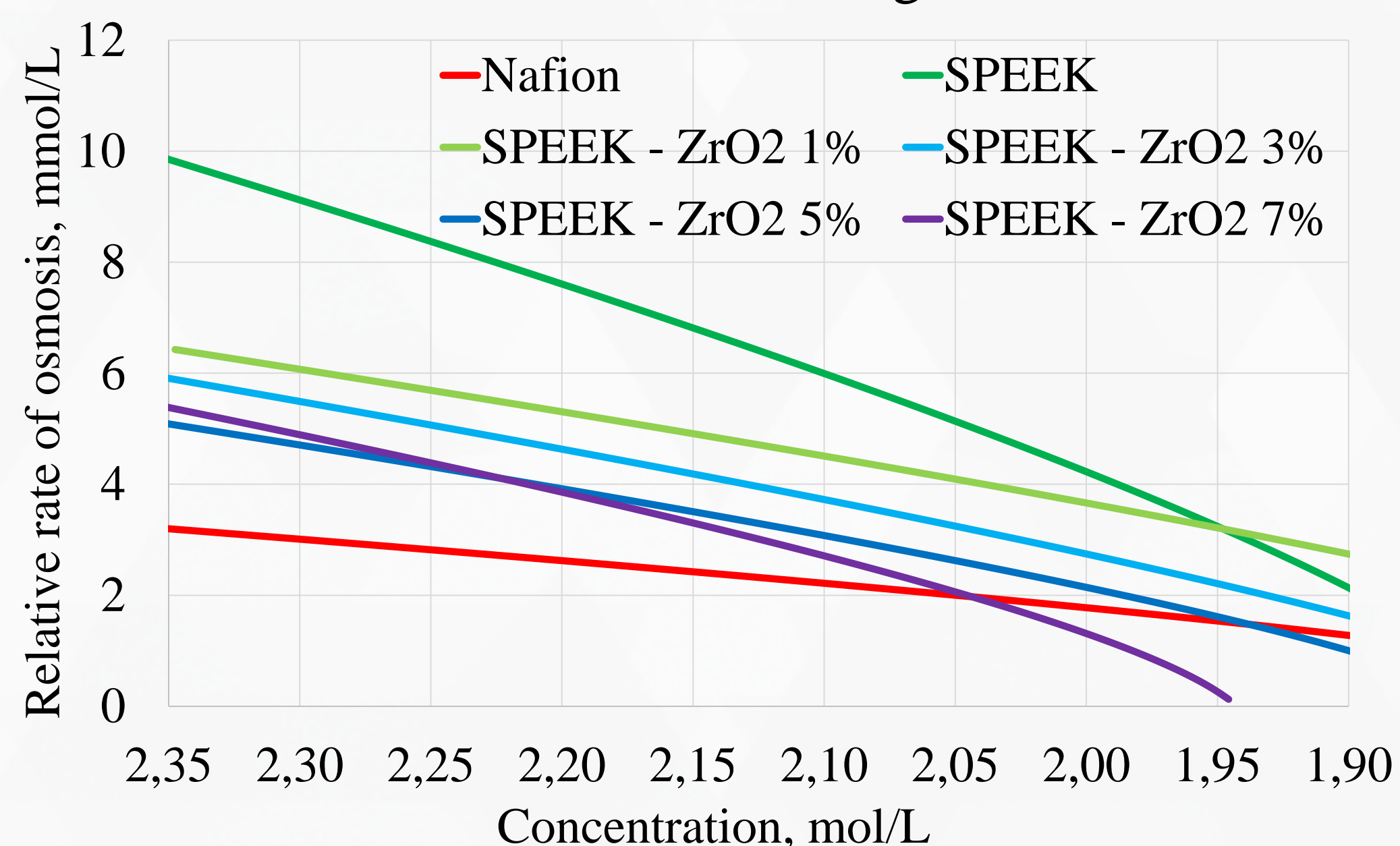
## Membrane preparation

Material of choice for membrane preparation was SPEEK – a polymer with suitable properties that is easily obtained by sulfonating poly (ether ether ketone) (PEEK). ZrO<sub>2</sub> membranes were prepared by dispersing the necessary amounts of ZrO<sub>2</sub> nanosuspension in a SPEEK/dimethylformamide solution, then pouring the mixture on a glass base and spreading it using doctor blade. Solvent was then evaporated in an oven.

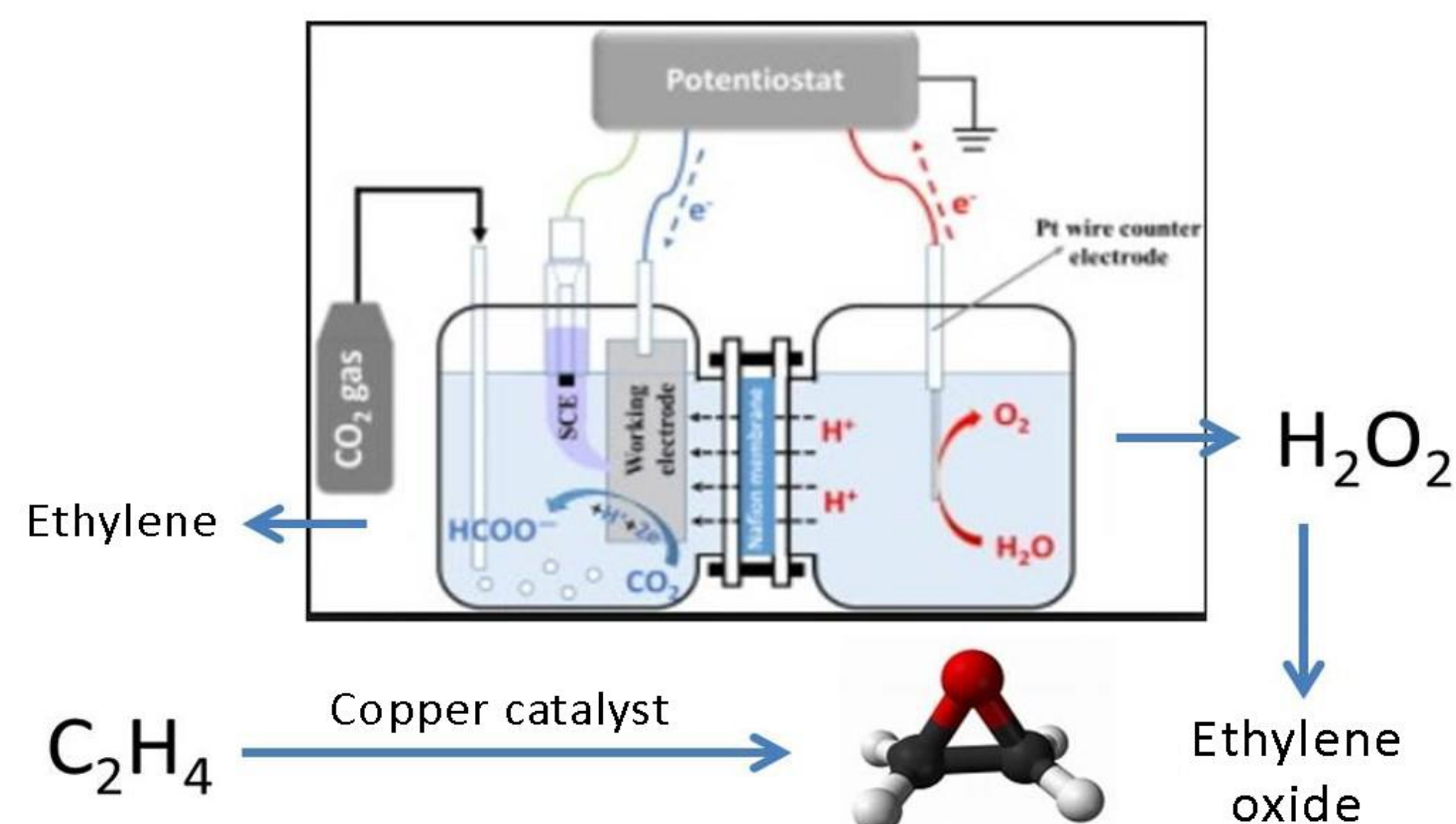
Relative rate of osmosis over time



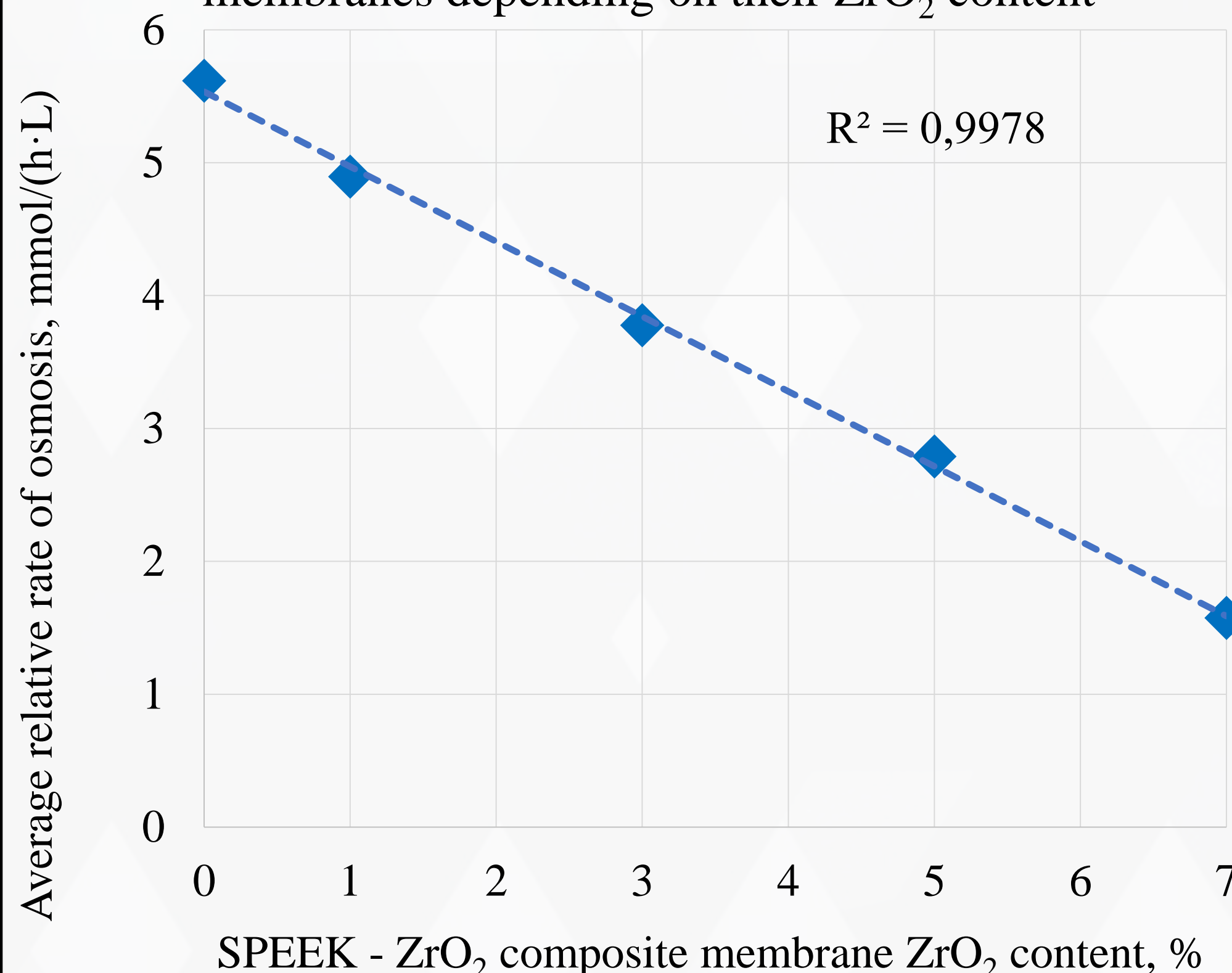
Relative rate of osmosis based on concentration changes



## CO<sub>2</sub> can be converted into more valuable organic compounds in an electrochemical reactor



Rate of osmosis through SPEEK – ZrO<sub>2</sub> composite membranes depending on their ZrO<sub>2</sub> content



## Conclusions

Rate of osmosis through SPEEK – ZrO<sub>2</sub> composite membranes exhibits a linear correlation with their ZrO<sub>2</sub> content in the 0-7% ZrO<sub>2</sub> content interval, with higher concentrations leading to reduced rate of osmosis. This property can be used to obtain membranes with fine-tuned osmotic properties, which are likely to be useful in electrochemical synthesis reactors and other applications where they are likely to be separating electrolytes of different concentrations.

## REFERENCES

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- [3] Wu, X.; Wang, X.; He, G.; Benziger, J. Differences in Water Sorption and Proton Conductivity between Nafion and SPEEK. *J. Polym. Sci. Part B Polym. Phys.*, 2011, 49 (20), 1437–1445. <https://doi.org/10.1002/polb.22326>.