

Metal-oxide crosslinked PDMS hybrids: high gas permeable materials on the way to I²CNER gas separation goals

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CO₂ gas separation with the usage of membranes is a promising method for industrial carbon capture due to potential capture cost reduction to the economically feasible values. Application of conventional organic polymers is limited due to existing trade-off relations between permeability and selectivity as well as fast physical aging, especially pronounced in thin membranes.

In current research we investigate the formation of the metal oxide (TiO₂, ZrO₂, Al₂O₃) crosslinked PDMS using the in-situ sol-gel of alkoxides with silanol terminated PDMS. Fig.1a shows the structural concept of fabricated hybrid materials referred as flexible ceramics¹⁻²⁾. Physical properties of hybrids were strongly influenced by two factors – content of the metal oxide and molecular weight of precursor PDMS-OH (Fig.1b). Notably, prepared membranes demonstrated superior gas separation performance compared to conventional PDMS i.e. both selectivity and permeability are increasing (e.g. Fig.1c for CO₂/N₂ pair separation using TiO₂/PDMS). Due to high gas permeability, developed materials can be used as gutter or caulking layer in composite membranes – alternatively to conventional PDMS or PTMSP. Problems of the conventional and importance of these new materials to achieve I²CNER goals for CO₂/N₂ gas separation will be discussed.

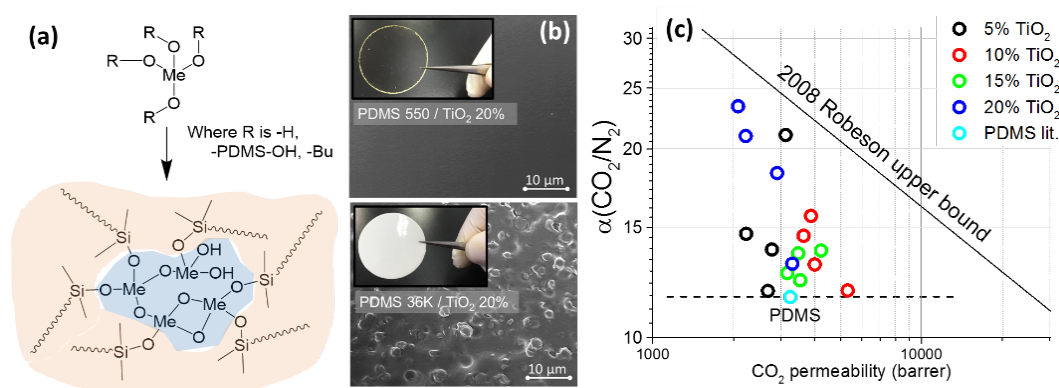


Figure 1. (a) Principle of metal oxide-PDMS composite (flexible ceramic) material formation; (b) membranes with high content of TiO₂ and different Mw of PDMS-OH; (c) CO₂/N₂ separation performance compared to conventional PDMS.

References

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