Preparation of macroporous hydrophobic flat-sheet PVDF membranes via vapor induced phase separation

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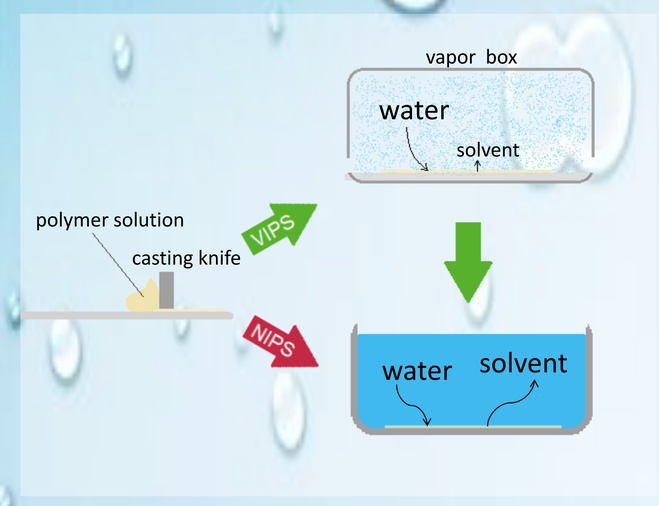
Non-solvent vs. vapor induced phase separation

membrane casting for VIPS (green arrows) and NIPS (red arrow)



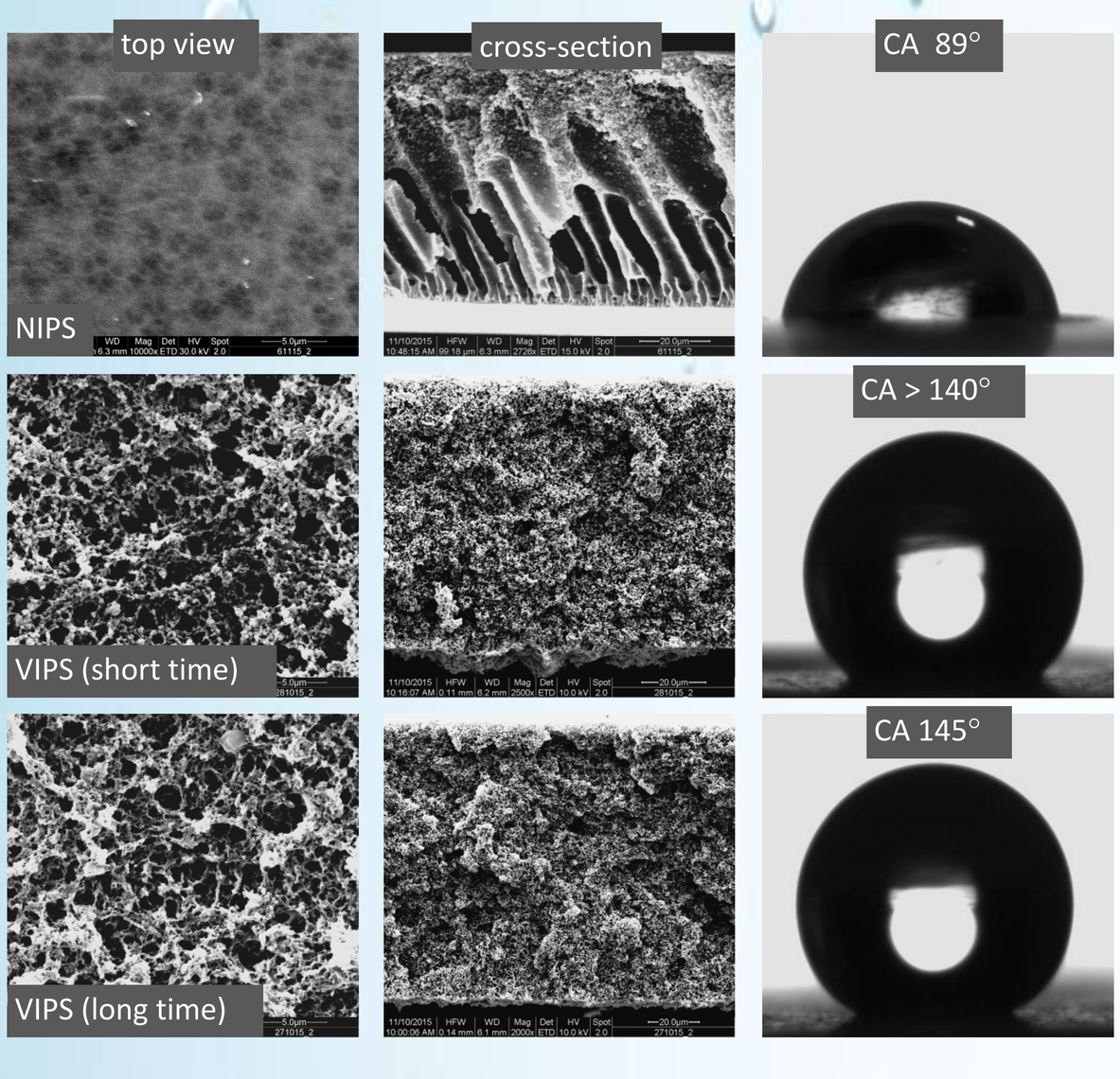
	VIPS	NIPS
structure	• isotropic • spongelike • rough surface	• anisotropic • finger pores • dense surface layer
pore characteristics	• microfiltration • narrow pore size distribution • porosity up to 90%	• ultrafiltration • porosity < 85%
pros/cons	+ highly hydrophobic - more difficult processing	+ simple set-up + well established - limitated porosity

Materials & methods

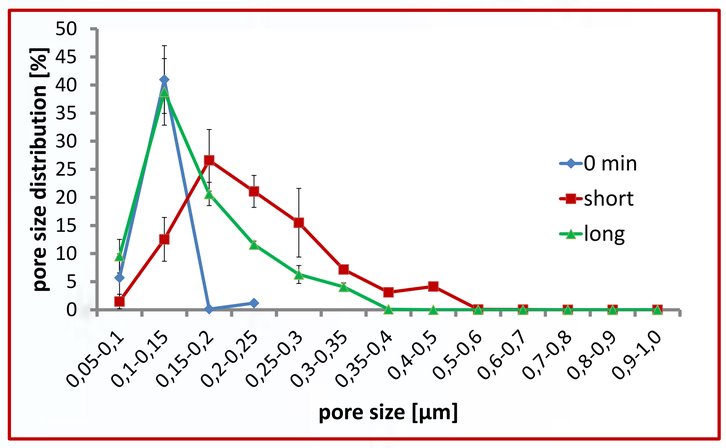
- PVDF/DMSO solution stirred over night at cnst. temp.
- VIPS & NIPS casting done at set <u>conditions</u>
  - relative humidity (NIPS < 30%)
  - exposure time
  - temperature
  - casting thickness
  - casting speed
  - air flow velocity
- <u>characterization</u>
  - SEM
  - porosity
  - perm porometry
  - thickness
  - gas permeability
  - contact angle

Results

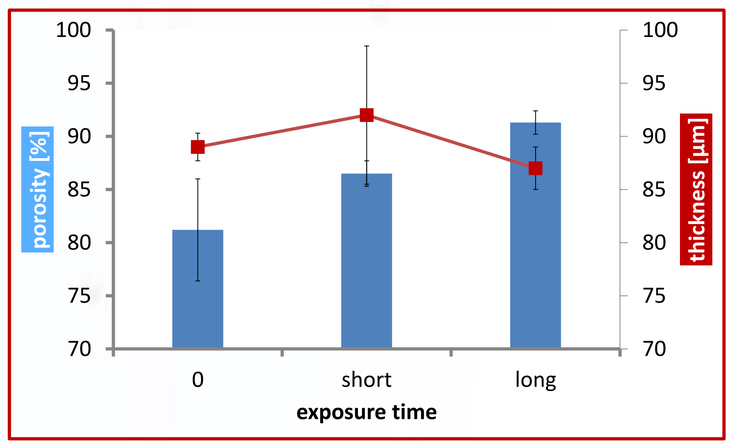
SEM images of membranes casted by the NIPS and VIPS method with short and long exposure time; contact angle measurements for no, short and long exposure time to humid air



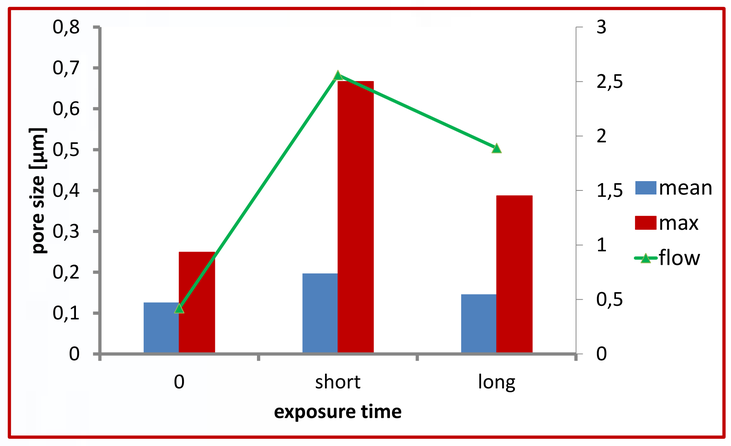
Frequency of pore size distribution



Porosity and thickness



Pore size and exposure time



Conclusion

- **VIPS** is a promising method for preparation of **highly porous** and isotropic membranes in the range of **microfiltration**
- Only 1 min of VIPS changes membrane structure drastically
- Pore size distribution for VIPS membranes is more narrow for long exposure time
- Even though the porosity is similar for NIPS and VIPS, VIPS membranes show much higher flux due to changes in membrane structure (finger like -> sponge like)

Outlook

- Parameters for the VIPS process need to be further explored in order to adjust certain specific membrane characteristics
- For even higher hydrophobicity membranes which can withstand plasma post treatment are of interest

Contact

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H2020 - GV - 2014 / GV - 2 - 2014 / RIA n° 653605

Acknowledgements

This work was supported by the EU Horizon 2020 project "XERIC – Innovative Climate-Control System to Extend Range of Electric Vehicles and Improve Comfort".