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A novel iso-porous membrane based on the green polymer with ultra-high porosity

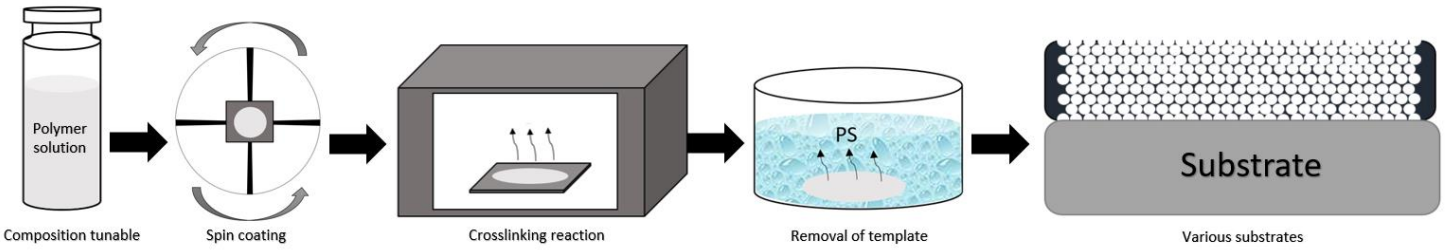
Xiaoyu Tan*, Cédric Buntinx*, Ivo F. J. Vankelecom*

* Membrane Technology Group, Centre for Membrane Separations, Adsorption, Catalysis and Spectroscopy for Sustainable Solutions, KU Leuven, Celestijnenlaan 200F, Box 2454, 3001, Heverlee, Belgium

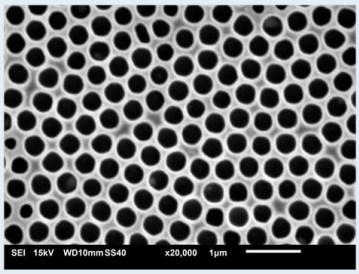
Research objective

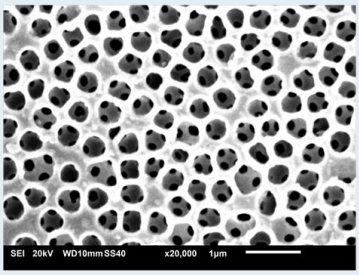
The aim is to develop a novel iso-porous membrane with inverse opal structures. A low-cost green polymer is chosen for this membrane, which makes this membrane an economical and ecologically friendly option. Thanks to the self-assembly of the nano-particle templates, this iso-porous membrane obtains an ultra-high porosity (up to ~$3x10^{13}$ pore/m^2, surface porosity>80%). By tuning the parameters, the porosity, pore size, and thickness of this iso-porous membrane could be well-adjusted. By applying the different crosslinking agents, the hydrophilicity of this membrane could be switched as well. Combined with a porous substrate and an ultra-thin, hydrophilic iso-porous top-layer, high water permeances were achieved (>4200 L m^{-2} h^{-1} bar^{-1}). This ultra-high porosity and narrow pore size distribution membrane could be beneficial for various biomedical applications (such as the removal of viruses), as well as in many other fields.

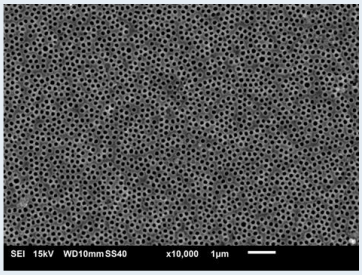
Membrane preparation

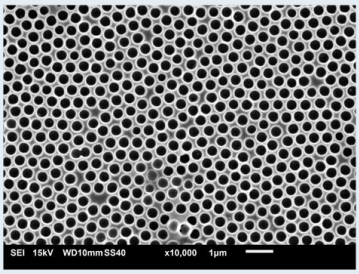


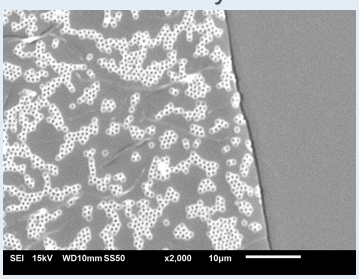
Morphology of iosporous membrane (pore size, porosity, thickness, self-standing, porous/dense substrates)

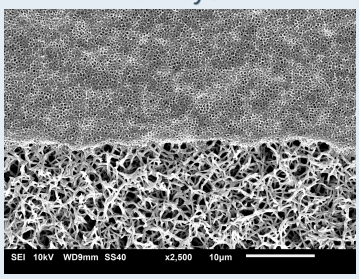

Mono-layer

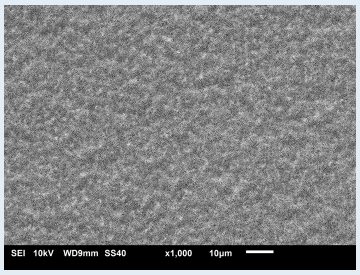

Multi-layer

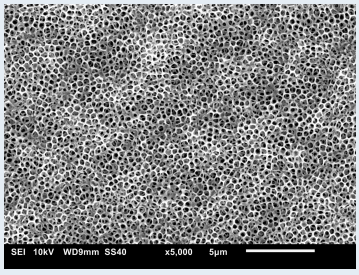

Pore size=100nm


Pore size=400nm


Self-standing


On porous substrate


Defect-free iso-porous layer


Ultra-high porosity

Hydrophilicity and water permeance