



## Grafting of ceramic membranes: boosting application potential in liquid filtration

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### Abstract

The wide chemical and temperature stability of ceramic membranes has promoted their application in a wide variety of challenging liquid filtrations. Since decades, they are no niche anymore in the membrane market. However, their intrinsic hydrophilic nature poses some limitations to their applicability.

This boundary can, however, be broken by chemically modifying the pore surface of the ceramic membranes. At VITO, Grignard chemistry has been the main work horse to realize this [1,2]. Grafting specific moieties on commercially available membranes in this smart way that does not jeopardize temperature and chemical robustness and at the same time offers wide flexibility, has shown to boost performance in organic solvents, anti-fouling properties in a variety of difficult streams, or affinity separations of very similar molecules. Not only downstream separations benefit, but also membrane reactors. Moreover, the positive effects are not limited to pressure driven filtrations, but have also been revealed in membrane contactor applications, or even enzyme immobilization and chromatography.

Comparison of native and grafted membranes have also brought us many new insights, and we are further exploring this path via data-driven modelling.

To create real value, the technology was successfully scaled, up to commercial, multichannel membrane scale, allowing different demonstrations on-site in industry. Subsequently, the technology was licensed to the company A-membranes, currently expanding the market readiness level.

Newer developments at VITO aim to increase the coverage of the grafted functional groups, and to design new applications. Today's sustainability and recycling targets, open up new horizons for grafted ceramic membranes, where polymeric membranes offer no alternative. Recent projects at VITO look e.g. at the development of membrane-based recycling of plastics (Flemish projects WATCH and RENOVATE), re-refining of used lubricant oil (EU project CUMERI), or purification of used cooking oil fermentation products (Flemish projects WODCA and LYPTIDA).

### References

- [1] A. Buekenhoudt, V. Meynen, B. Maes, P. Cool "Surface-modified inorganic matrix and method for preparation thereof", Patent EP 09155686 (filing 20.03.2009)
- [2] V. Meynen, J. Van Dijck, H. Beckers, A. Buekenhoudt, "Method for producing an organic functionalised inorganic substrate" Patent EP 21 184 075.6 (filing 06.07.2021)