Mixed Matrix Membranes With In-Situ Synthesized Dendrimer Particles: Preparation, Characterization and Applications to SusChEM

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Polymeric membranes have become the critical components of a broad range of sustainable chemistry, engineering and materials (*SusChEM*) related applications including 1) energy generation and storage, 2) water treatment, reuse and desalination and 3) biopharmaceutical separations and purifications. The convergence between membrane science and nanotechnology is providing unprecedented opportunities to develop a new generation of mixed matrix membranes (MMMs) with embedded functional nanoparticles. Such membranes are being designed to carry out multiple functions (e.g. retention, sorption and catalysis) with improved properties and performance including higher permselectivity and flux, greater mechanical strength and lower fouling propensity. In this presentation, I will describe a facile and simple route to the preparation of mixed matrix polyvinylidene fluoride (PVDF) with *in situ* synthesized dendrimer particles (DPs). The critical step of our novel methodology is the *in situ* synthesis of DPs in the dope solutions prior to membrane casting using commercially available low-generation PAMAM dendrimers (G0 and G1) with terminal primary amine groups as precursors and epichlorohydrin (ECH) as crosslinker. By using a combined thermally-induced phase separation (TIPS) and non-solvent phase separation (NIPS) casting process, we successfully prepared a new family of mixed matrix asymmetric PVDF membranes with (i) sponge-like microstructures, (ii) surface layers with thicknesses of 8-12 μm and average pore diameters of 22-45 nm and (iii) high loadings (~48 wt%) of crosslinked PAMAM particles with average diameters of ~1.3-2.4 μm. Preliminary experiments suggest that our new MMMs with *in situ* synthesized DPs could be serve as 1) high capacity chelating membranes for Cu(II) recovery from aqueous solutions and 2) substrates for the preparation of catalytic membranes with *in situ* synthesized supramolecular dendrimer hosts for Pt(0) nanoparticles.