**Ethylene and Ethane Transport Properties of Hydrogen-stable Ag+-based Facilitated Transport Membranes**

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**Abstract:** Previous studies on Ag+-containing facilitated transport membranes report high olefin-paraffin selectivity (e.g., ethylene over ethane) but poor stability of the Ag+ carrier, especially in the presence of reducing gases, such as H2, H2S, and C2H2 which are often present in industrial process streams. Solid polymer electrolytes consisting of crosslinked poly(ethylene glycol) diacrylate and up to 70 wt% silver bis(trifluoromethylsulfonyl)imide (AgTf2N) salt are synthesized through a facile and scalable UV-crosslinking process. Following over 10 weeks of pure H2 permeation at 4 bar and 35˚C, the membrane retains over 90% of its initial pure gas ethylene-ethane selectivity. X-ray photoelectron spectroscopy does not detect a change in the oxidation state of the dissolved Ag+ ions. At the highest AgTf2N concentration (70 wt%), pure-gas ethylene-ethane selectivity and permeability are 21 and 4.0 Barrer, respectively, yielding performance surpassing the polymeric gas separation membrane upper bound. Dual-mode ethylene sorption is observed and modeled using a chemical equilibrium model, and gas diffusivity is calculated according to the solution-diffusion model.