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Polymeric Carbon Dioxide Capture Membranes for Artificial Photosynthesis DANIEL MILLER, NATHANIEL LYND, Lawrence Berkeley Natl Lab — Production of carbon-rich fuels via artificial photosynthetic processes depends on the continuous availability of a carbon source. In a proposed artificial photosynthetic system, hydrogen and oxygen from solar water splitting are combined with CO_2 captured from the atmosphere to produce a liquid fuel such as methanol. Membrane-based processes provide advantages over other gas separation technologies, including mechanical simplicity, a relatively small footprint, and energy efficiency. We describe the synthesis and characterization of polymeric anion exchange materials for CO_2 concentration from gas mixtures such as the atmosphere. Transport of CO_2 through the membrane is promoted by an opposing flux of water, which reacts with CO_2 through equilibrium reactions to form charged species (bicarbonate, carbonate, and hydroxide) within the membrane. CO_2 transport will be discussed as a function of membrane material characteristics, including charge density, and process characteristics, including feed stream relative humidity and CO_2 concentration on each side of the membrane. The development of several membrane materials will be discussed. Results of experimental gas transport studies will be presented.

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