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Gas Permeation through Polystyrene-Poly(ethylene oxide) Block Copolymers DANIEL HALLINAN JR., Dept. of Chem. and Biomed. Eng., FAMU/FSU, MATTEO MINELLI, MARCO GIACINTI-BASCHETTI, DICMA, University of Bologna, NITASH BALSARA, Dept. of Chem. Eng,, UC Berkeley — Lithium air batteries are a potential technology for affordable energy storage. They consist of a lithium metal anode and a porous air cathode separated by a solid polymer electrolyte membrane, such as PEO/LiTFSI (PEO = poly(ethylene oxide), LiTFSI = lithium bis-trifluoromethane sulfonimide). For extended operation of such a battery, the polymer electrolyte must conduct lithium ions while blocking electrons and gases present in air. In order to maintain a pressure difference the membrane must be mechanically robust, which can be achieved by incorporating the PEO into a block copolymer with a glassy block such as PS (PS = polystyrene). To protect the lithium electrode, the membrane must have low permeability to gases in air such as CO_2, N_2, and O_2. We have therefore studied the permeation of pure gases through a PS-PEO block copolymer. A high molecular weight, symmetric block copolymer with a lamellar morphology was used to cast free-standing membranes. Gas permeability was measured through these membranes with a standard, pressure-based technique. A model was developed to account for transport through the polymer membrane consisting of semi-crystalline PEO lamellae and amorphous PS lamellae. PEO crystallinity was extracted from the permeation model and compares well with values from differential scanning calorimetry measurements.

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