Cryogenic Permeation of Helium through Polymer Films

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Cryogenic permeation of helium is important for the development of light-weight insulation systems and cryogenic fluid storage. However, few to no measurements are available in the literature. To address this need, a custom membrane support structure was used to measure helium permeation rates with a calibrated Adixen Graph D+ variable mass leak detector. Steady-state measurements of helium permeation are reported between 30 and 150 K. The measurements were performed in accordance with ASTM D1434-82, where possible, and additional testing procedures were adopted to improve the repeatability of the measurements. Measurements on specialized PET barrier films, crystalline PEEK, and other polymer films with potential cryogenic applications are presented.