

## Engineering Polymeric Materials for Barriers, Hollow Fiber Membranes, and Hybrid Sorbents: A Path to a More Sustainable Future

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The conventional separation processes are largely dependent on a thermally-driven phase change process, consuming approximately 45% of the production energy in downstream petrochemical and manufacturing processes. More advanced membrane-based separation technique, a pressure-driven process, will allow us to save a significant amount of our energy and achieve a sustainable future. The understanding of gas/vapor transport in polymeric membranes is critical and can be applied for many applications: barrier material development, membrane based gas separation, and hybrid sorbent development. In fact, all of these applications are related to the same fundamental principle, the sorption-diffusion mechanism. Antiplasticization-based transport studies on poly(ethylene terephthalate) were conducted to improve barrier properties for advanced packaging material development. Also, fundamental studies on membrane-based gas separation were performed with more advanced hybrid membrane development. Lastly, a new carbon capture system has been pursued via hollow fiber-supported ionic liquid sorbents.