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# Nanofiber-Ionic Liquid Capsule Composite Membrane Mats for CO2 Capture

-Background Carbon dioxide (CO2) emissions continue to be the major contributor of climate change. Solving this issue is a major hurdle currently facing the world. Various ionic liquids have shown promising affinity towards the selective capture of CO2. With the viscosity of the ionic liquids, its sorptive capacity for CO2 is limited by diffusion kinetics and surface area in contact with CO2. In effort to significantly boost surface area in contact with CO2 and improve sorption kinetics, researchers have investigated ways to effectively immobilize ionic liquids in hollow polysulfone micro/nano capsules or membranes. However, current ionic liquid encapsulation methods are typically slow, complex, require multiple steps, and yield relatively large capsules with diameters between about 50 μm and 500 μm.  Invention Description Researchers at Arizona State University have developed an electrospray encapsulation method in combination with electrospinning to achieve nanofiber membrane capsule composites. A single step is used in which air-controlled electrospraying is performed simultaneously with electrospinning onto a stationary or rotating collector to obtain polymer nanofiber-ionic liquid capsule hybrid membranes. This electrospray-electrospin process is fast, scalable, tunable, and can be used to obtain a wide variety of polymer shells and polymer nanofiber mats. The resulting capsules, which typically have a diameter between 500 nm and 10 μm, are formed without sonification.  Depending on application, the electrospray encapsulation process may be isolated to give capsules alone.  Potential Applications •    Atmospheric carbon dioxide capture •    Ionic liquid encapsulation Benefits and Advantages •    Faster and simpler than competing methods •    Achieves smaller capsule sizes in the 500 nm to 10 μm range •     Capsule shell and fiber material can be easily changed •    Tunable parameters include: capsule thickness and size; nanofiber diameter; and membrane porosity and thickness •    No drying or emulsification required •    Suitable for continuous processes unlike the batch processes used in emulsion-based encapsulation methods •    Allows for spray/spin onto surfaces or direct embedding into polymer membrane composites, whereas conventional methods require additional steps to embed capsules in membrane composites Research Homepage of Professor Matthew Green