Membranes for Direct Lithium Extraction (DLE)

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Abstract : Several direct lithium extraction (DLE) technologies have been developed for Li extraction from different brines. Although laboratory studies showed that they can technically recover Li to 90%, challenges still remain in developing a sustainable process that can serve as a foundation for the lithium dependent low-carbon economy. There is a continuing quest for DLE technologies that do not need extensive pre-treatments, fewer materials, and have simplified extraction processes with high Li selectivity. Here, an overview of DLE technologies will be provided with an emphasis on the basic principles of the materials' design for the development of membranes with nanochannels and nanopores with Li ion selectivity. We have used a variety of building blocks such as nano-clay, organic frameworks, Graphene/oxide, MXene, etc., to fabricate the membranes. Molecular dynamic simulation (MD) and density functional theory (DFT) were used to reveal new mechanisms by which high Li selectivity was obtained.