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Abstract

A novel dendritic microchanneled membrane has been prepared using a mesh-guided phase inversion process. A mesh-guided phase inversion mechanism is proposed to explain the formation mechanism of the microchannels. It is believed that the mesh influenced the formation of microchannels by restricting the organic solvent diffusion rate. The dendritic microchanneled structure was analysed using scanning electron microscopy and 3D reconstruction technologies. The microchanneled structure in this dendritic structure is found to be very different from the previously fabricated microchanneled membrane structure because the microchannels are formed by merging many small microchannels into larger channels with lateral dimensions corresponding to the mesh aperture size. It is confirmed that this structure offers a thin dense layer, a large surface area, good connectivity of microchannels and broad gas diffusion paths. As a result, the $La_{0.6}Sr_{0.4}Co_{0.2}Fe_{0.8}O_{3-\delta}$ membrane with dendritic microchanneled structure demonstrates a very high oxygen permeation rate, 3.4 ml cm^{-2} min^{-1} at 900 °C.

Graphical abstract