

Layer by Layer Coating of Zinc Oxide/Metal Organic Framework Nanocomposite on Ceramic Support for Solvent/Solvent Separation Using Pervaporation Method

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Abstract : Metal-organic frameworks (MOFs) have attracted considerable interest due to its diverse pore size tunability, fascinating topologies and extensive uses in fields such as catalysis, membrane separation, chemical sensing, etc. Zeolitic imidazolate frameworks (ZIFs) are a class of MOF with porous crystals containing extended three-dimensional structures of tetrahedral metal ions (e.g., Zn) bridged by Imidazolate (Im). Selected ZIFs are used to separate solvent/solvent mixtures. A layer by layer formation of the nanocomposite of Zinc oxide (ZnO) and ZIF on a ceramic support using a solvothermal method was engaged and tested for target solvent/solvent separation. Metal oxide layer was characterized by XRD, SEM, and TEM to confirm the smooth and continuous coating for the separation process. The chemical composition of ZIF films was studied by using X-Ray absorption near-edge structure (XANES) spectroscopy. The obtained ceramic tube with metal oxide and ZIF layer coating were tested for its packing density, thickness, distribution of seed layers and variation of permeation rate of solvent mixture (isopropyl alcohol (IPA)/methyl isobutyl ketone (MIBK)). Pervaporation technique was used for the separation to achieve a high permeation rate with separation ratio of > 99.5% of the solvent mixture.

Keywords : metal oxide, membrane, pervaporation, solvothermal, ZIF

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