
Templated Sol-Gel Synthesis for Fabrication of Mesoporous Silica/Alumina Hybrid Membrane Nanocomposites

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ABSTRACT

Mesoporous silica with high surface area and uniform channel distribution has been developed via liquid crystal templating materials such as amphiphilic triphenylene derivatives capable of having anisotropic and spontaneous alignment. However, amphiphilic triphenylene was only reported as a template to synthesize mesoporous silica nanocomposite with parallel structure to the substrate. Therefore, by introducing a one-dimensional (1D) template-limiting material such as porous alumina membrane, it was expected that the resulting hybrid membrane would give vertically alignment of self-assembled organic compounds to give high performance of nanocomposites for potential application in energy devices. Herein we report that mesoporous silica/alumina hybrid membrane with interpore distance of 2.5 nm was successfully fabricated by an amphiphilic triphenylene ($\text{TP}_{\text{C}_{10}\text{TEG}}$) as a template in sol-gel synthesis of mesoporous silica ($\text{TP}_{\text{C}_{10}\text{TEG}/\text{silicahex}}$) in the anodized alumina membrane (AAO). $\text{TP}_{\text{C}_{10}\text{TEG}/\text{silicahex}}$ showed an anisotropic arrangement due to the π - π stacking based on presence of absorption peak at 264 nm. In addition, the hexagonal arrangement of $\text{TP}_{\text{C}_{10}\text{TEG}/\text{silicahex}}$ was proved based on their transmission electron microscope (TEM) images and diffraction peaks of d_{100} and d_{200} at $2\theta = 2.52^\circ$ and 5.04° , respectively. For fabrication of mesoporous silica/alumina hybrid membrane, simple approach of using vacuum or gravitational filtration was used for immobilization of $\text{TP}_{\text{C}_{10}\text{TEG}/\text{silicahex}}$ to AAO membrane. X-ray diffraction (XRD) analysis on the resulting hybrid nanocomposite showed that the diffraction peaks of d_{100} and d_{200} of $\text{TP}_{\text{C}_{10}\text{TEG}/\text{silicahex}}$ were still preserved, indicating that the hexagonal arrangements of mesoporous silica were maintained even after the fabrication. Likewise, the morphology study of the resulting hybrid membrane using TEM, scanning electron microscope (SEM), and field emission scanning electron microscope (FESEM) will be carried out and the results will be discussed later.

| Amphiphilic triphenylene | Alumina hybrid membrane | Hexagonal arrangements | Mesoporous silica | Sol-gel synthesis |

Effect of stirring in the oxidation of 1-octene by using various types of catalysts

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ABSTRACT

In recent times, oxidation of alkenes has become one of the most important industrial reactions. One of the products from this reaction is epoxide, where an intermediate is usually used to synthesize a variety of fine chemicals. In this research, the oxidation of 1-octene, a type of alkene, has been carried out by using different types of catalysts. Apart from that, the effect of stirring and static condition in the oxidation of 1-octene was also investigated. The catalysts used were magnetite, silica coated magnetite ($\text{SiO}_2@\text{Fe}_3\text{O}_4$), cobalt Schiff base complex, cobalt Schiff base complex/ $\text{SiO}_2@\text{Fe}_3\text{O}_4$, cobalt oxide and cobalt oxide/ $\text{SiO}_2@\text{Fe}_3\text{O}_4$. The characterization of catalysts were carried out by using Fourier transform infrared spectroscopy (FTIR), scanning electron microscopy (SEM), thermal gravimetry analysis (TGA), diffuse-reflectance UV-visible spectroscopy (DRUV-vis) and X-ray diffraction (XRD). Gas chromatography (GC) was used to analyze the products from the reaction. From the result, it shows that cobalt complex with stirring condition displayed the highest conversion of 1-octene and highest selectivity towards the products, compared to the other catalysts used.

| oxidation | 1-octene | stirring | static condition synthesis |
