Kanchana Luepong 2010: Development of $Au/CeO_2/Al_2O_3$ Catalytic Membrane Reactor Via Electro-spinning and Sol-Gel Techniques for Water Gas Shift Reaction. Doctor of Engineering (Chemical Engineering), Major Field: Chemical Engineering, Department of Chemical Engineering. Thesis Advisor: Associate Professor Paisan Kongkachuichay, Ph.D. 78 pages.

This research was focused on developing a catalytic membrane reactor (CMR) assembling of three layers: supporting layer, gas separating layer, and catalytic layer that were made of porous alumina disk, alumina gel synthesized via a sol-gel technique, and ceria (CeO_2) fibers doped with gold synthesized via electrospinning technique, respectively. The fabricated CMR was used for converting CO to CO_2 and H_2 through the water gas shift reaction. The alumina layer was prepared by hydrolyzing aluminum tri-sec butoxide mixed with i-butanol as diluent. The acetylacetone (ACAC) was added into the mixed solution to control the gel morphology. The gel was aged at room temperature for 2 days then it was calcined at 500^{o}C for 1 hour. The obtained alumina was found to have 36 Å pore size diameter with narrow distribution, 560.3 m^2/g surface area, and 0.6 cc/g pore volume. Subsequently, it was spin-coated on the porous alumina disk forming the gas separating layer having 1 mm thickness. Before fabricating the ceria layer via electrospinning process, the effect of co-solvent (i-propanol and water), supplied electrical voltage, and distance between needle tip and ground collector were studied to determine the optimum condition for spinning ceria fibers. Consequently, the smooth electrospun fibers were produced using 50 wt % of i-propanol, 18 kV electric field, and 8 cm distance between needle tip and collector. After calcined at 450^{o}C for 3 hours, the obtained fibers were confirmed to be ceria structure having an average diameter of 600 ± 80 nm. Then the ceria fibers were spun and deposited on the alumina gel layer and incipient wetness impregnated with $HAuCl_4$.

Finally, the water gas shift reaction was conducted in three types of reactors composing of the same catalyst ($Au/CeO_2/Al_2O_3$): fixed bed, CMR, and hybrid CMR (fixed bed combined with CMR). At the optimum condition, 250^{o}C and 45 min, the corresponding CO conversion was, 52.31, 21.78 and 97.69, respectively. Therefore, the hybrid CMR yielded the best performance.

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