Fabrication of ionic liquid membrane using Cu nanoparticles and porous materials for facilitated transport and the increase of diffusivity

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Ionic liquid membranes have showed low permeance, due to high viscosity when utilized for gas separation. Low permeance occurs limitation of practical application despite advantages such as high thermal stability and high CO_2 selectivity. In this study, Copper nanoparticles (CuNPs) prepared by redox reduction with Fe^{2+} ions and porous KIT-6 were utilized for high selectivity and as a permeable membrane. When positively polarized CuNPs were generated by ionic liquid 1-butyl-3-methyl imidazolium tetrafluoroborate (BMIM BF_4) and porous KIT-6 materials were incorporated into BMIM BF_4/CuNPs. The selectivity for CO_2/N_2 and CO_2/CH_4 of the composite membrane was largely increased to 16.4 to and 23.4, respectively. while neat BMIM BF4 was 5.0 and 4.8, respectively. Furthermore, the CO_2 permeance was also enhanced from 17 to 50.7 GPU, compared to the neat BMIM BF_4 membrane. These enhancements of separation performance is attributed to both the facilitated transport by polarized Cu NPs and the increase of diffusivity by the porous material KIT-6.