Synthesis of amphiphilic graft copolymer membranes for gas permeation

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Amphiphilic graft copolymers comprising poly(vinyl chloride) (PVC) main chains and poly (vinylpyrrolidone) (PVP) side chains, i.e. PVC-g-PVP, were synthesized via atom transfer radical polymerization (ATRP). Successful synthesis of the graft copolymer was confirmed confirmed by 1H NMR, FT-IR spectroscopy, and gel permeation chromatography (GPC). Transmission electron microscope (TEM) and small angle X-ray scattering (SAXS) analysis revealed the well-defined microphase-separated structure of the graft copolymer into hydrophobic PVC and hydrophilic PVP domains and the domain spacing increased from 21.4 to 23.9nm with increasing grafting degree. All the membranes exhibited amorphous structures and high Young's modulus and tensile strength, as revealed by wide angle X-ray scattering (WAXS) and universal testing machine (UTM). Permeation experimental results using a CO2/N2 (50/50) mixture indicated that CO2 permeability increased dramatically as amount of PVP increased, because PVP caused increasing of diffusivity due to the disruption of chain packing in PVC.