Study of accelerated molecular transport mechanism of glassy polymer films derived from thermal rearrangement

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Inorganic microporous and mesoporous materials are of great technological importance as heterogeneous catalysts and adsorbents due to their high surface areas. Presently, we have discovered glassy amorphous polymers having unusual microporous structure from thermal rearrangement of confined polymer chains in the solid state. Firstly, we built five kinds of hydroxyl-group containing polyimides (HPIs) by thermal imidization. These membranes were thermally treated at 450 °C for 1 hr to acquire thermally, chemically stable polybenzoxazole (PBO) membranes. Gas permeable characteristics and molecular transport mechanism of these polymers were investigated as their polymer backbone structure. PBO membranes showed high gas permeable characteristics for various kinds of gases (O_2, N_2, CO_2, H_2, CH_4) with high gas selectivity. Additionally, we carried out several analyses to confirm the thermal rearrangement during the heat treatment such as XRD, BET sorption, TGA and so on. The PBO membranes showed good performance for gas separation applications and had inherent possibilities to other processes such as adsorption, catalysis and energy generation.