A series of tetraamine diphenyl sulfone (TADPS) based polybenzimidazoles (PBIs) were synthesized. The monomer, TADPS, was synthesized via a novel and economical route. The monomer has a sulfonyl linking moiety, which results in a kinked morphology in the polymer backbone (**Figure 1**). Compared to the commercial PBI (Celazole®), these novel PBIs exhibit better solubilities in common solvents without sacrificing thermal or chemical integrity. Additionally, these PBIs have excellent gas transport properties at elevated temperatures.[1]

Our approaches to improve the gas transport properties of TADPS-based PBIs are: 1. blending the PBI with polyethylene oxide (PEO) or polypropylene oxide (PPO) that decompose and produce volatile components on controlled heat treatment, and 2. grafting propylene oxide onto the polybenzimidazole backbone by ring opening polymerization from the imidazole amines by anionic polymerization. In both methods, by degrading volatile components, blended PEO, PPO or grafted PPO blocks, through controlled heat treatment, nanoscale voids are expected to be introduced into the film, enhancing gas permeability.

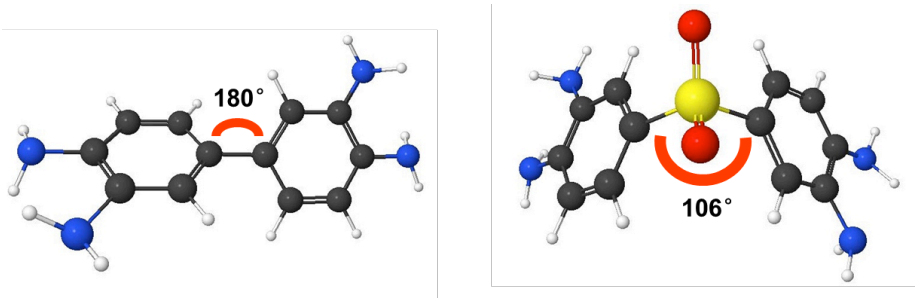


Figure 1. Difference in chemical structure between Celazole® monomer (left) and TADPS (right) illustrating introduction of kinked morphology in the polymer backbone.

References:

1. H. Borjigin, K. A. Stevens, R. Liu, J. D. Moon, A. Shaver, S. Swinnea, B. D. Freeman, J. S. Riffle, J. E. Mcgrath. *Polymer.*, **2015**, *71*,135-142