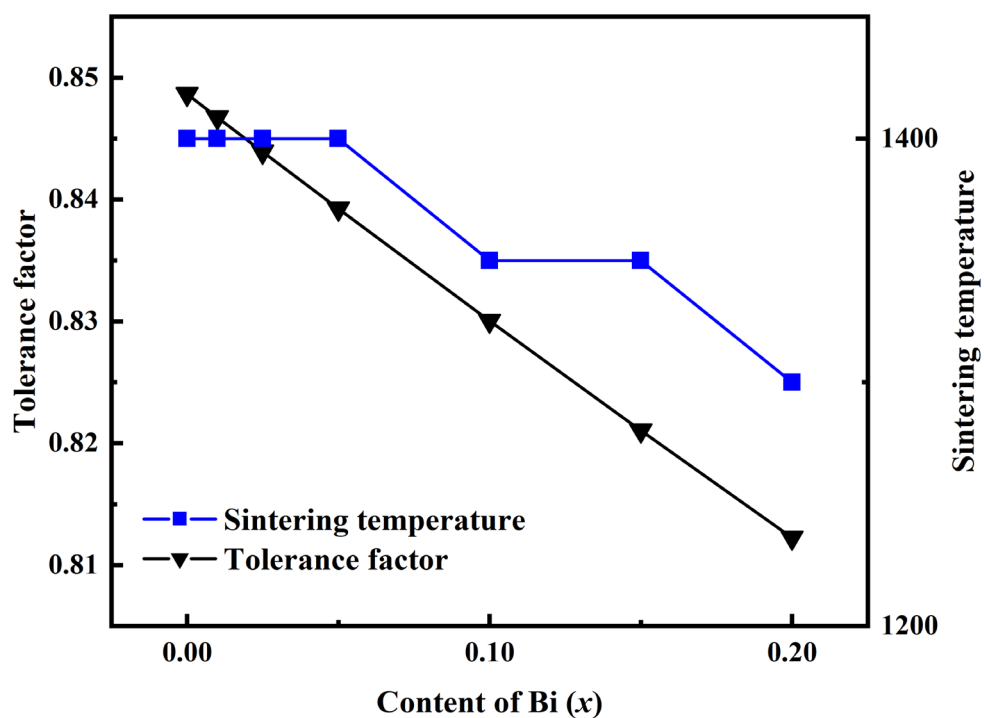


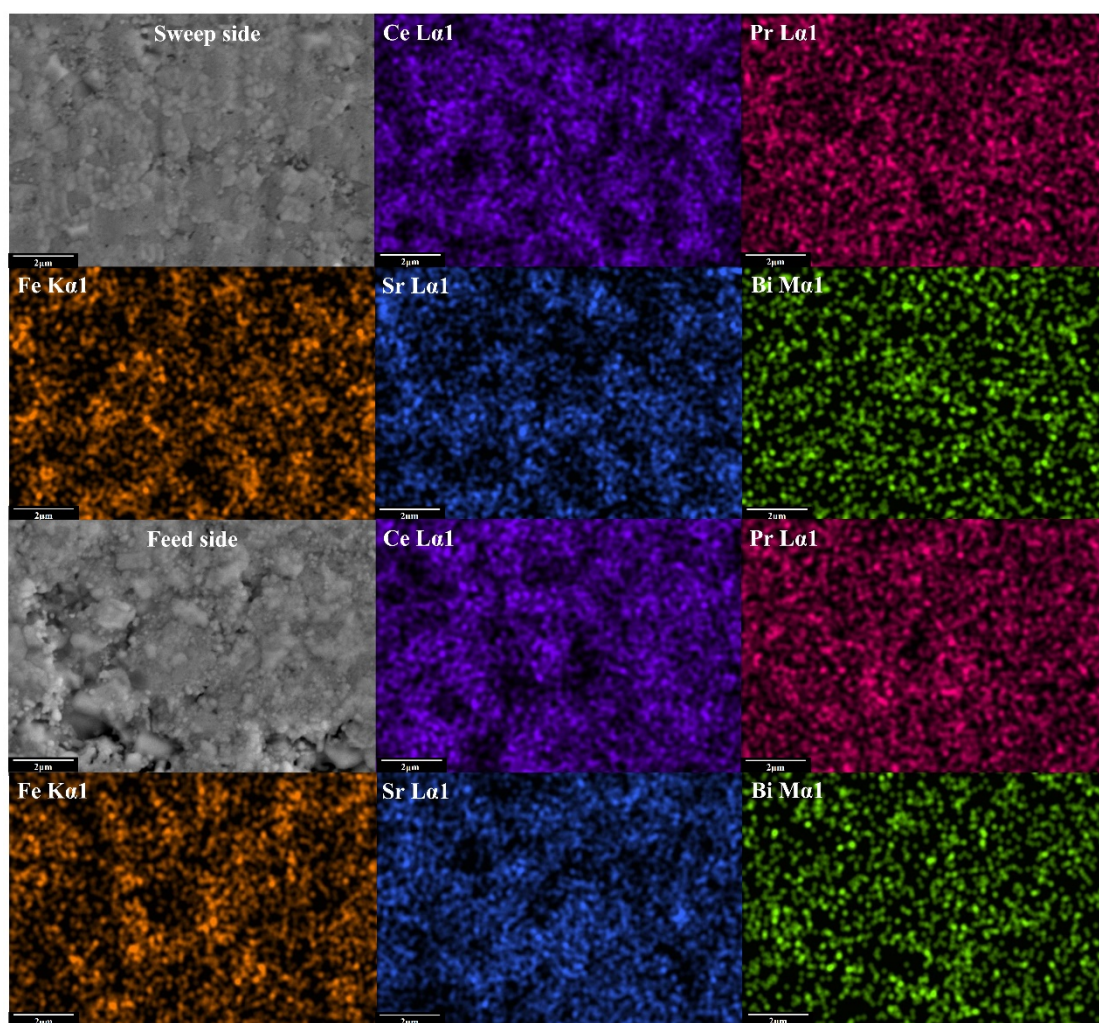
## Supporting Information



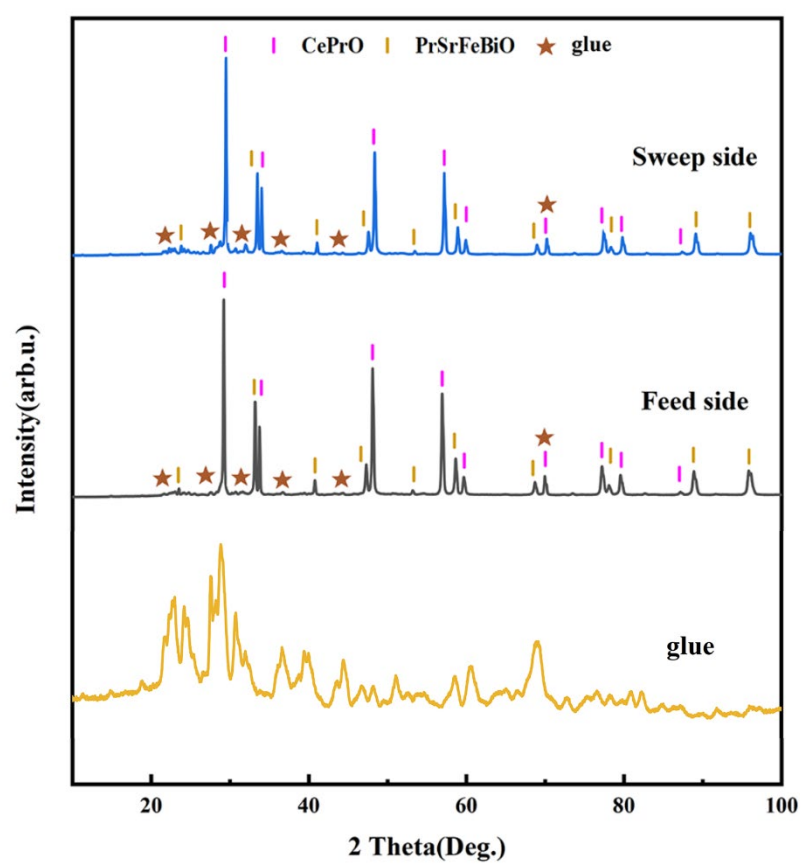
**Figure S1.** The tolerance factors and sintering temperatures of 60CPO-40PSF<sub>1-x</sub>B<sub>x</sub>O as a function of contents of Bi ( $x$ ).

**Table S1.** Density of fresh dual-phase 60CPO-40PSF<sub>1-x</sub>B<sub>x</sub>O membranes

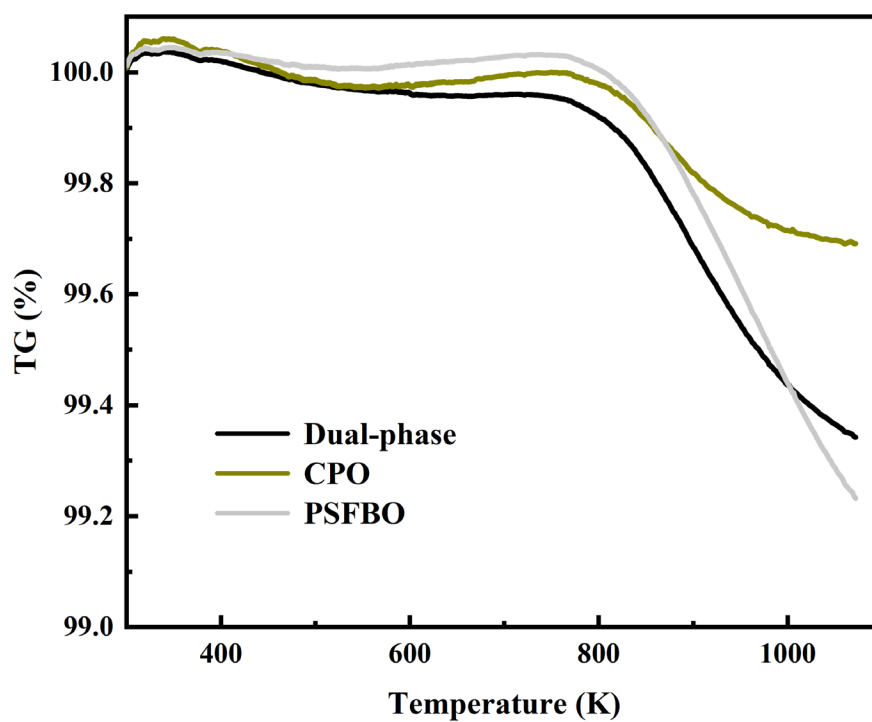
	Theoretical density (g/cm <sup>3</sup> )	Volume density (g/cm <sup>3</sup> )	Porosity	Relative density
$x = 0.01$	6.8594	6.2498	8.89%	91.11%
$x = 0.025$	6.8889	6.3756	7.45%	92.55%
$x = 0.05$	6.9365	6.3756	8.09%	91.91%
$x = 0.1$	7.0099	6.7129	4.24%	95.76%
$x = 0.15$	7.1278	6.7165	5.77%	94.23%
$x = 0.20$	7.2126	6.5964	8.54%	91.46%



**Figure S2.** SEM images and EDXS mappings of two sides of the spent 60CPO-40PSFB<sub>0.01</sub>O membrane.



**Figure S3.** XRD patterns of two sides of the spent 60CPO-40PSFB<sub>0.01</sub>O membrane and glue for sealing.



**Figure S4.** TGA results of 60CPO-40PSFB<sub>0.01</sub>O, CPO and PSFB<sub>0.01</sub>O powders.