Influences of the chain structure of PE-*b*-PEG on the properties of PE/PE-*b*-PEG blend membranes prepared by TIPS

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Introduction:

A series of diblock copolymer polyethylene-*b*-poly(ethylene glycol)s (PE-*b*-PEGs) with various molecular weight of PE segment are prepared and blended with linear low-density PE. The PE/PE-*b*-PEG porous membranes are obtained by thermally induced phase separation (TIPS) process. The isothermal crystallization kinetics of PE/LP/PE-*b*-PEG blends are investigated to study the effects of PE-*b*-PEG with different molecular weight on the properties of PE/PE-*b*-PEG membranes. AFM, SEM, mercury porosimetry method are used to characterize the microstructure of the membranes. The water flux properties, wettability, carbon ink rejection performance and protein adsorption behaviors of the membranes are studied.

Synthesis of PE-*b*-PEG

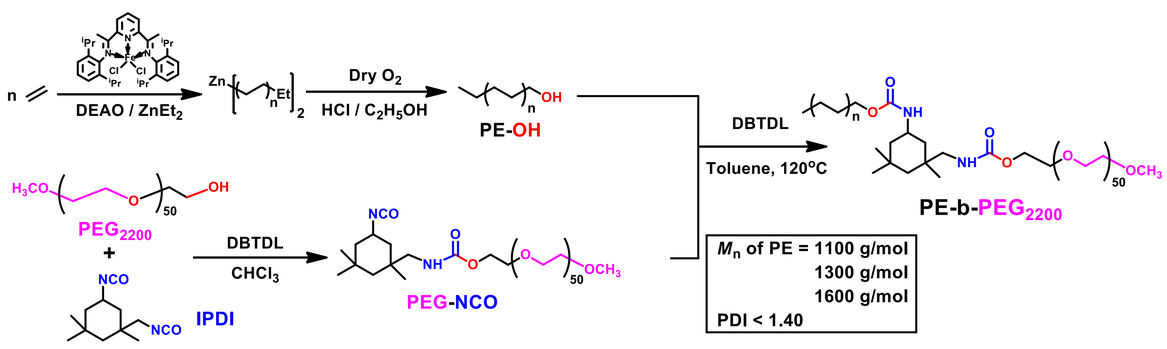

Fig. 1. Synthesis of PE-*b*-PEG by combination of CCTP and coupling reaction of isocyanate.

Discussion

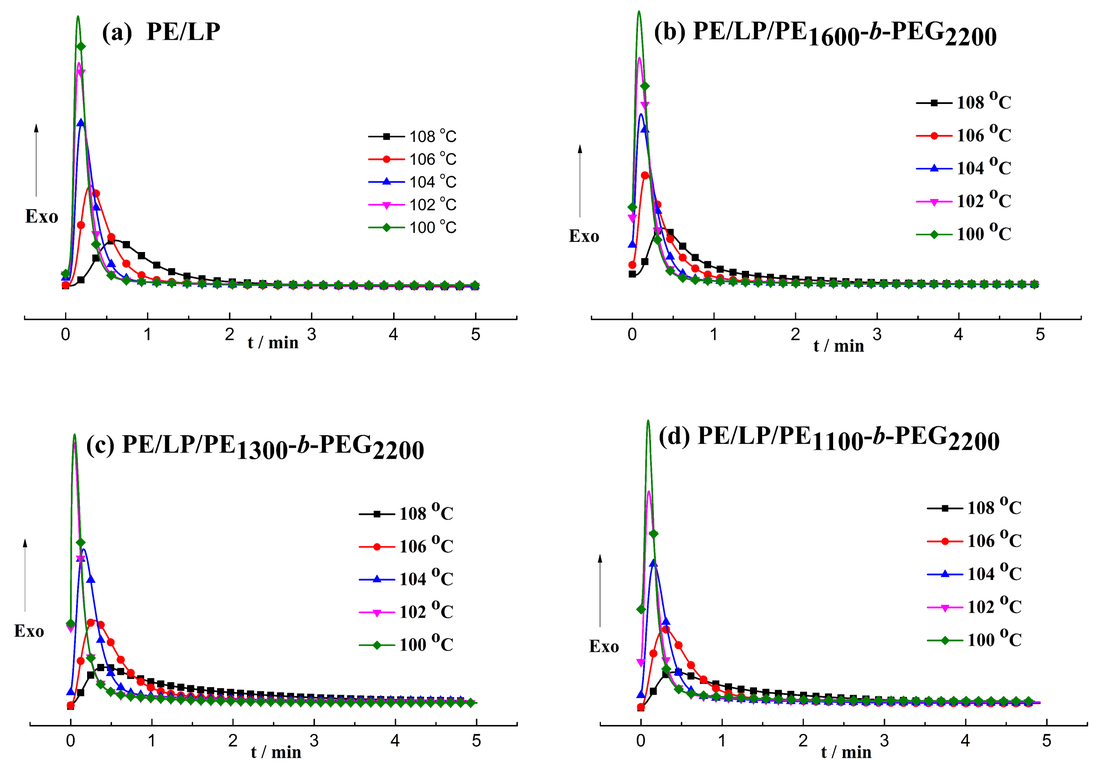

Fig. 2. Plot of heat flow vs. time during isothermal crystallization of PE/LP/PE-*b*-PEG mixtures.

Table 1. Parameters of isothermal crystallization of PE/LP/PE-b-PEG mixtures.

Sample	T_c(℃)	K [a]	n [a]	$t_{1/2}$(s)[b]
PE/LP	100	177.58	3.31	0.19
PE/LP/ PE_{1600}-*b*-PEG_{2200}		17.96	1.60	0.13
PE/LP/ PE_{1300}-*b*-PEG_{2200}		21.32	1.64	0.12
PE/LP/ PE_{1100}-*b*-PEG_{2200}		37.89	1.88	0.12

a. K and n are determined from the initial linear section of $\ln[-\ln(1-X_t)]$ *vs.* ln t.

b. Calculated by substituting n and Z into $t_{1/2} = (\ln 2 / K)^{1/n}$.

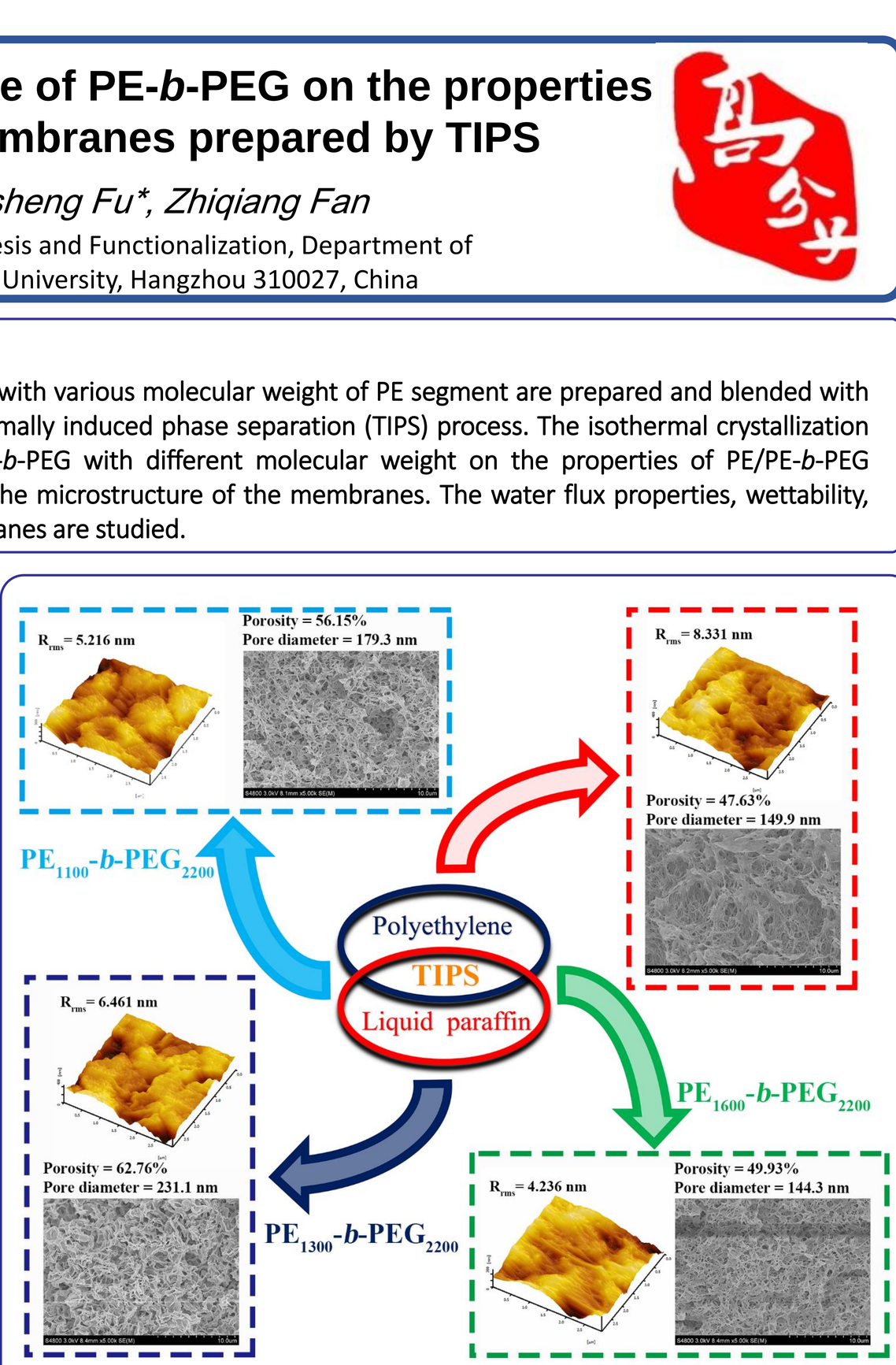

Fig. 3. AFM, SEM images, pore diameter, porosity and root mean square roughness of PE or PE/PE-*b*-PEG membranes.

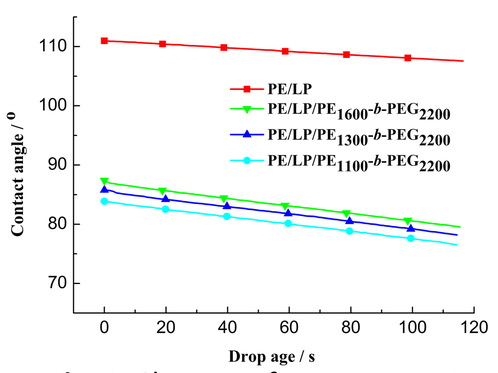

Fig. 4. Changes of water contact angle with time of PE membranes.

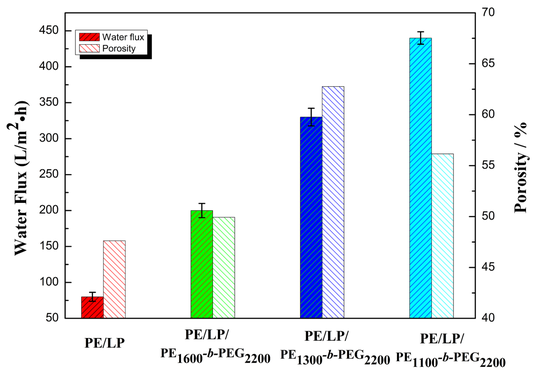

Fig. 5. Porosity and water flux of PE membranes.

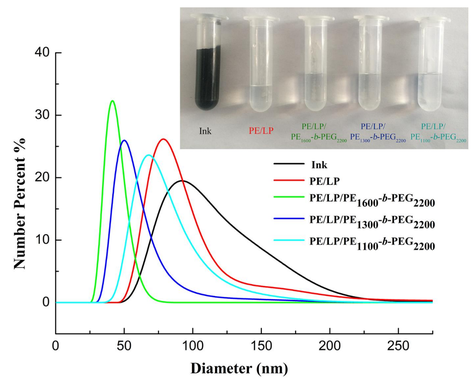

Fig. 6. The carbon ink rejection performance of PE membranes.

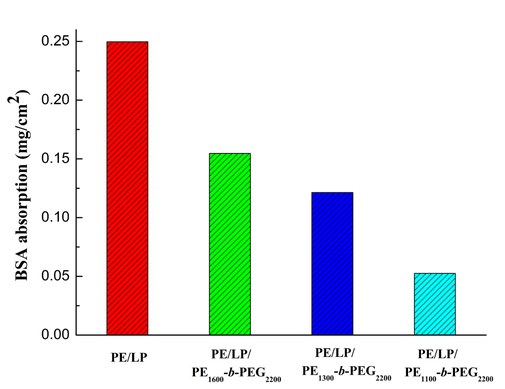

Fig. 7. BSA adsorption of PE membranes.

Conclusions

- The introduction of PE-*b*-PEGs with different PE segments molecular weight , the isothermal crystallization kinetics behavior of PE/PE-b-PEG blends could be tuned effectively.
- Different crystallization behavior of PE or PE/PE-b-PEGs lead to the difference in the microstructure and properties of the membranes.

Acknowledgement

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References

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[2] Zhisheng Fu, et. al., *J APPL POLYM SCI*, 2015, 132(28):1097-4628.