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## Design of pendent imidazolium side chain with flexible ether-containing spacer for alkaline anion exchange membrane

Xue Gong<sup>1</sup>, Xiaoming Yan<sup>2</sup>, Tiantian Li<sup>1</sup>, Xuemei Wu<sup>1\*</sup>, Wanting Chen<sup>1</sup>, Shiqi Huang<sup>1</sup>, Yao Wu<sup>1</sup>,  
Dongxing Zhen<sup>1</sup>, Gaohong He<sup>1,2\*</sup>

<sup>1</sup>State Key Laboratory of Fine Chemicals, Research and Development Center of Membrane Science and Technology, School of Chemical Engineering, Dalian University of Technology, Dalian, 116024, China

<sup>2</sup>School of Petroleum and Chemical Engineering, Dalian University of Technology, Panjin, 124221, China

xuemeiw@dlut.edu.cn

hgaohong@dlut.edu.cn

\*Corresponding author. Fax: +86-411-84986291, Tel: +86-411-84986291.

\*Corresponding author. Tel: +86-427-2631916.

### Abstract

A novel approach is proposed to design anion exchange membranes (AEMs) containing pendent imidazolium side chains with flexible ether-containing spacer by the Williamson etherification between chloromethylated polysulfone and as-synthesized hydroxyl-bearing imidazolium. The introduction of long flexible ether-containing spacer chains enhances the mobility of terminated imidazolium groups and ion interactions. It facilitates the formation of a good hydrophilic/hydrophobic micro-phase separation structure, which is confirmed by the scattering peak of SAXS. As a result, the membranes exhibit high conductivity and excellent anti-swelling ability. The membrane with IEC of 1.55 mmol g<sup>-1</sup> shows considerable hydroxide conductivity (72 mS cm<sup>-1</sup>, 60 °C), low swelling ratio (7.3 %, 60 °C), and great tensile strength in hydrated state (43.4 MPa, 20 °C). The existence of long spacer chain also improved the alkaline stability. After immersion in 60 °C, 1 M KOH solution for 168 h, hydroxide conductivity and tensile strength of the membrane remain constant. The ether-containing side chains fabricated in this work provides a universal promising method to balance hydroxide conductivity and dimensional and alkaline stability.

**Keywords:** anion exchange membrane; ether-containing spacer; micro-phase separation; hydroxide conductivity; dimensional and alkaline stability

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