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Synthesis of Poly(N-2,3-dihydroxypropyl aspartamide) (PDHPA) and the Crosslinked Hydrogel for Various Applications
당꿔닷, 김지흥† 성균관대학교
In this study, a new kind of multi-hydroxy synthetic polymer and preparation of the crosslinked gels are proposed. Poly(N-2,3-dihydroxypropyl aspartamide) (PDHPA), a poly(amino acid) with peptide backbone having pendent 1,2-dihydroxy functional groups, is prepared from the precursor polymer, polysuccinimide, through aminolysis using 3-amino-1,2-propanediol. This polyaspartamide derivative has several valuable properties including biodegradability, high water solubility, excellent biocompatibility, strong adhesive, and low production cost. Due to its unique chemical structure, PDHPA provides a useful platform to combine with other materials and also to prepare its dynamically reversible and self-healing hydrogel.

1PS-76 리몽안
Alkaline Anion Exchange Membrane from Poly(arylene ether ketone)-*g*-Polyimidazolium Copolymer for Enhanced Hydroxide Ion Conductivity and Thermal, Mechanical, and Hydrolytic Stability
리몽안, 김덕준[1,†] 성균관대학교; [1]School of Chemical Engineering, Sungkyunkwan University
a series of alkaline anion exchange membranes (AAEMs) are synthesized from poly(arylene ether ketone)-poly(vinyl-1-butylimidazolium) graft copolymers (PAEK-*g*-[PBVIm-OH]) with different [PBVIm-OH] cationic chain lengths. The PAEK-*g*-[PBVIm-OH]-based AAEMs show excellent hydroxide ion conductivity without sacrificing thermal, mechanical, and dimensional stability. The hydroxide ion conductivity increases with increasing PBVIm-OH graft chain length. The AAEM membrane with the longest PBVIm-OH chain length shows the highest hydroxide conductivity of 0.00878 S cm^{-1} at 40 ℃ and the highest elongation of 206.7% in the hydrate state as well as the highest power density of 22 mW cm^{-2} at a current density of 55 mA cm^{-2}, which is very promising for fuel cell applications.

1PS-77 마현지
Inverse Bicontinuous Cubic Mesophases of Giant Amphiphiles with Tunable Lattice Constant and the Demonstration of Correlation of Molecular Weight with Lattice Periodicity
마현지, 김경택† 서울대학교
Well-defined brush block copolymers (BBCPs) have attracted research interest in recent years because of their unusual topology, conformation, and chain dimension. In spite of their extreme molecular weights (>1 MDa), these BBCPs exhibit excellent dynamics in condensed phases arising from their low chain entanglement. Here we report the synthesis of diblock copolymers containing poly(ethylene glycol)s and polystyrenes as brushes tethered to the polynorbornene backbone. The resulting megaamphiphiles self-assembled into a variety of micellar and vesicular structures. Also, striking morphological diversity was exhibited, which presumably arises from the high molecular weight of megaamphiphiles and fast chain dynamics. Our results suggest that the periodic nanostructures having large periodicity in three-dimension could be created by simple solution self-assembly of megaamphiphiles. Furthermore, the correlation of molecular weight of BBCPs with lattice periodicity was investigated.

기능성 고분자 (I)

1PS-78 Abu Zafar Al Munsur
Tuning the Cross-linker Lengths and Cross-linking Processes for the Development of Robust Anion Exchange Membranes
Abu Zafar Al Munsur, 김태현† Incheon National University
The anion exchange membrane fuel cells (AEMFCs) have been noticed as an emerging power source because of their several advantages over the proton exchange membrane-based fuel cells (PEMFCs). Development and designing of anion exchange membranes with good mechanical, chemical stability, and hence long durability, together with high conductivity, is still a challenge for real application of anion exchange membrane fuel cells. There have been several approaches adopted for making robust anion exchange membrane, and cross-linking is one of the most widely used techniques for getting those desirable properties. Herein we have studied a broad spectrum of cross-linker length, cross-linking methodology and their effect on AEM properties that will be discussed in detail.

1PS-79 Assel Seitkazina
Photosensitizing Polymer Nanoparticles for Cancer Immunotherapy
Assel Seitkazina, 정근수[1], 김세훈[2,†] University of Science and Technology-Korea Institute of Science and Technology Campus; [1]서울대학교; [2]KIST
In consequence of investigating the interaction of the immune system with the cancer cells, polymeric nanoparticles (NPs) in combination with photodynamic therapy (PDT) and immunotherapy appears to be a next generation therapeutic strategy that can eliminate primary tumors, inhibit metastases and prevent tumor relapses. Here, we devised combined method on the basis of polymeric nanoparticles with co-encapsulated photosensitizing agent and Toll-like-receptor-7 (TLR-7) targeting adjuvant. We next investigated cell toxicity of PDT treated cells and *in vitro* dendritic cells activation. As a result Western blot and flow cytometry data demonstrated that the presence of adjuvant triggered more intensive immune response. Further findings during *in vivo* tumor model experiments suggest that NPs can be applied for near-infrared (NIR) light-triggered PDT and cause ablation of primary tumors with following prevention of metastases.

1PS-80 Eprillia Intan Fitriasari
Preparation of Mechanochemichally Responsive Mesoporous Silica Particle Encapsulated by Water-Soluble Polyurethane for Drug Delivery System
Eprillia Intan Fitriasari, 박치영† Pukyong National University
Mechanochemically responsive hybrids material of successively releasing small molecule has been developed. In this research, Rhodamine B molecules were successfully encapsulated into the pore of MCM-41 mesoporous silica by waterborne hyperbranched polyurethane and Fe(III) ions using one-step assembly method. The dye molecule release was measured by applying mechanical compression and the optical absorption investigated by UV-vis absorption spectra. The results indicate that the difference on mechanical stimuli applied has great influence on the amount of Rhodamine B molecules released. The ease, low cost, and scalability of the assembly method makes these hybrids material potential candidates for drug delivery systems application.

* **1PS-81** Iqubal Hossain
PEG- and PDMS-functionalized Crosslinked Norbornene Copolymer Membranes Prepared by in-situ ROMP for CO_2 Separation
Iqubal Hossain, 김태현† 인천대학교
The development of high performance materials for carbon dioxide separation and capture will significantly contribute to a solution of global warming and natural gas purification. Polymer membrane-based gas separation has attracted recent interest due to their ease of operation, low operational cost and compactness in module preparation. The gas separation performance of most of the current polymers, however, does not meet the requirements of highly efficient separation for the industrial applications. We report herein, crosslinked norbonene copolymers having both PEG-and PDMS-units as highly CO_2-soluble and permeable groups, respectively by in-situ ROMP polymerization as novel CO_2 separation membranes. A series of crosslinked copolymers were prepared by tunning the ratio between PEG and PDMS units, and their properties including gas separation performance will be discussed in details.

1PS-82 JIELING QIN
Ultra-Sensitive Amyloid-β Sensor with Gold Nanoparticles and Conducting Polymers Composite Electrode for Early Diagnosis of Alzheimer's Disease
JIELING QIN, 조미숙, 이영관† 성균관대학교 화학공학부
In this work, an electrochemical sensor was prepared using gold nanoparticles-poly (3,4-ethylenedioxythiophene-poly(thiophene acetic acid) [AuNPs-PEDOT-PTAA] to immobilize cellular prion protein (PrP^C) for the detection of amyloid beta oligomer (AβO). AuNPs and PEDOT composite electrode induced a high conductivity and then, provided the high sensitivity to AβO sensing. PEDOT was enhanced the electrical conductivity and the adhesion between PTAA and the composite electrode. The thiol and carboxyl groups of PTAA were played the linking agent between the composite electrode and the amine-terminated PrP^C peptide. The impedance response of the optimized AuNPs-PEDOT-PTAA biosensor showed a proportional relationship with the concentrations of AβO in the range from 10^{-2} fM to 10^2 mM. The sensitivity at a femtomolar level and high selectivity to the AβO can be used in practical for the early diagnosis of Alzheimer's disease.

1PS-83 Kusuma Betha Cahaya Imani
Human-Blood-Vessel-Resembling Double-Walled Microtube Hydrogels Prepared by Triple Channels Microfluidic System
Kusuma Betha Cahaya Imani, 윤진환†, 김도완 Pusan National University
In this study, we prepared microtube hydrogels with poly(*N*-isopropylacrylamide) (PNIPAm) and poly(acrylamide) (PAAm) as the inner and outer wall respectively. Triple channels microfluidic device combined with alginate-templated photopolymerization was used to allow the preparation of two separated hydrogel walls. The different property of the hydrogel walls enables the microtubes to have the human blood vessel behavior. By increasing the temperature, the thermally active inner wall shrinks while the passive outer wall maintaining its position, which results in a higher flux. In addition, the hydrogel walls can be reversed to have a thermally controllable outer diameter with a stationary hollow center by simply swapping the injection position of the pre-gel solutions. This flexibility suggests that this method can be applied for various hydrogel monomers.

1PS-84 Mayadevi T S
Quarternary Ammonium-functionalized Poly(ether sulfone ketone) Block Copolymer Membranes: the Block Ratio Effect on the Properties of Anion Exchange Membranes
Mayadevi T S, 김태현† 인천대학교
Anion exchange membranes based on quarternary ammonium functionalized poly(ether sulfone ketone)s block copolymers (QA-PESK) having various hydrophilic-hydrophobic oligomer block ratios were synthesized, and the effect of the block length on the membranes' physicochemical and electrical properties was systematically investigated.

Tunable hydrophobic side-chain poly(styrene-ethylene-*co*-butylene-styrene) tri-block copolymer as highly conductive and stable anion exchange membranes

Abu Zafar Al Munsur, Tae-Hyun Kim*

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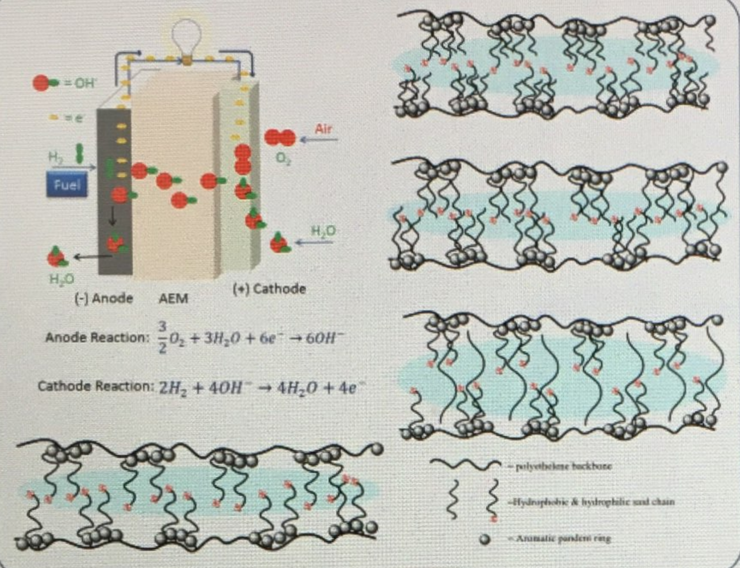
ABSTRACT

There is a surge of interest in the development of anion exchange membrane fuel cells (AEMFCs) in the renewable energy research. The high conductivity and stability under high pH conditions at elevated temperatures are required for AEMs. We report herein the tunable hydrophobic side chain SEBSs as novel anion exchange membranes. The synthesis and properties of these newly developed AEMs are described.

INTRODUCTION



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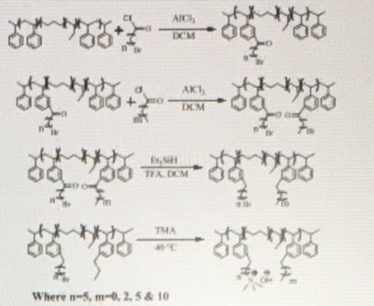

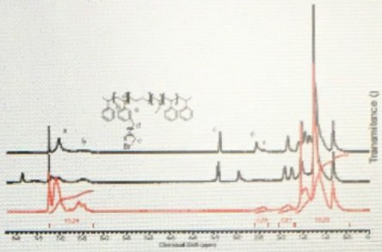

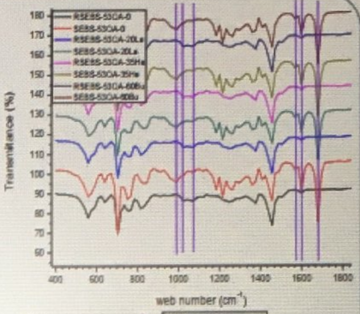

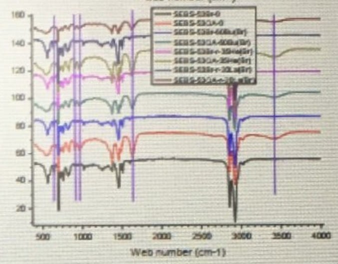

PROPERTIES

Table 1. IEC & Conductivity data for the hydrophobically modified SEBS membranes at various temperature in their OH⁻ & Br⁻ form.

Membrane Code	IEC (mmol/g)			Conductivity(mS/cm)							
	Theoretical	Experimental		In OH⁻ form				In Br⁻ form			
	NMR	Acid-Base Tit.	Mohr's	r.t. °C	40 °C	60 °C	80 °C	r.t. °C	40 °C	60 °C	80 °C
SEBS-53QA-0	1.59	1.40±0.01	1.44	35.5	42.5	57.9	72.7	11.4	21.7	32.8	45.5
SEBS-53QA-60Bu	1.48	1.32±0.01	1.35	50.4	71.0	89.6	107.3	13.1	22.1	33.4	47.2
SEBS-53QA-35He	1.48	1.34±0.01	1.33	48.7	63.4	79.7	94.0	14.1	21.9	32.0	45.6
SEBS-53QA-20La	1.48	1.31±0.02	1.34	49.5	67.6	86.7	103.5	14.9	21.6	34.3	46.7

Table 2. Water Uptake , In-plane, Through plane Swelling ratio at 20 & 80 °C temperature and the density measurement.

Membrane Code	Water Uptake (%)			Swelling Ratio (%)		Density measurement (g/cm³)	
				In-plain	Through-plain		
	20 °C	80 °C	λ	20 °C	80 °C	Dry	wet
SEBS-53QA-0	101.6	124.4	40.3	39.1	11.5	1.05	1.03
SEBS-53QA-60Bu	154.1	149.2	64.9	37.0	18.4	1.02	1.01
SEBS-53QA-35He	146.4	140.3	60.7	37.0	20.7	1.02	1.02
SEBS-53QA-20La	149.1	146.0	63.2	39.9	18.5	1.02	1.02

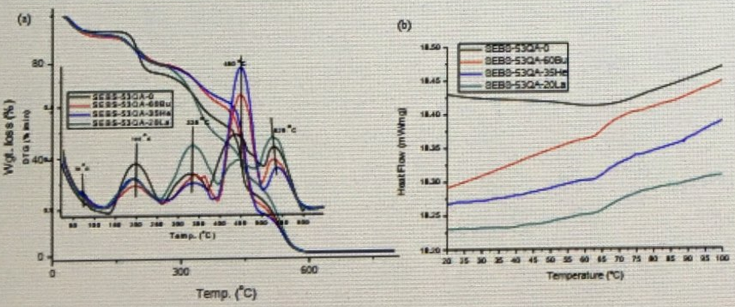

Figure 1. TGA thermogram and derivative curve (a) and DSC curve (b) for the hydrophobically modified SEBS membranes.

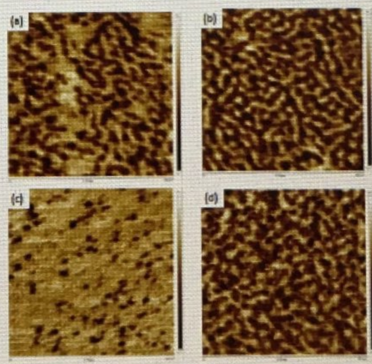

Figure 3. AFM phase image of SEBS-53QA-0 (a); SEBS-53QA-60Bu (b); SEBS-53QA-35He (c); SEBS-53QA-20La (d).

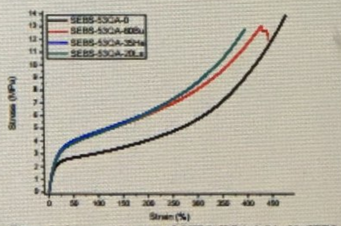

Figure 4. Stress-strain curve of SEBS-53QA-0 (black); SEBS-53QA-60Bu (blue); SEBS-53QA-35He (red); SEBS-53QA-20La (pest).

Table 3. Mechanical Properties at 50% R.H and room temperature .

Membrane Code	Tensile strength (TS) (MPa)	Break at Elongation (%)	Young's Modulus (MPa)
SEBS-53QA-0	13.9	481.3	0.18
SEBS-53QA-60Bu	13.0	445.2	0.20
SEBS-53QA-35He	9.2	320.0	0.21
SEBS-53QA-20La	12.8	398.9	0.19

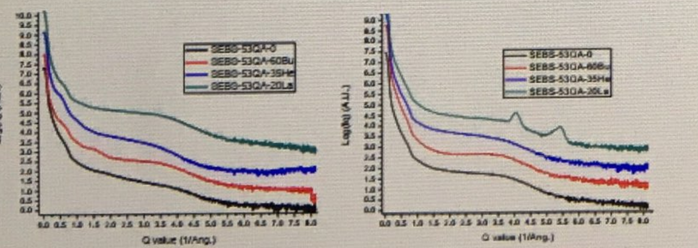

Figure 2. SAXS profile for OH⁻ (a) and Br⁻ (b) for the hydrophobically modified SEBS membranes.

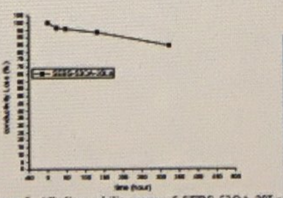

Figure 5. Alkaline stability curve of SEBS-53QA-20La.

- Easy and convenient Friedel-Craft acylation methodology was used in polymer synthesis.
- The hydrophobic side chain while maintaining their structural integrity and make some trapped free volume inside the polymer matrix.
- The free volume absorbs water, that facilitate conductivity and alkaline stability.

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