

나노튜브의 배향을 통한 CO₂ 분리용 혼합매질 분리막 제조 및 모듈 개발

Mixed Matrix Membranes Aligned Nanotubes and Modules for CO₂ Separation



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최종연구목표

- 고투과 분리막 소재 및 모듈을 이용하여 배가스에서 발생하는 이산화탄소를 효과적이며 경제적으로 포집
- 배향된 나노물질이 함유된 분리막을 이용한 실증 플랜트에 적합한 고투과형 고분자 분리막 소재 및 모듈 개발

주요연구내용

- CO₂ active 나노상 물질 개발 및 제거기술 개발평가
- 나노 tube의 고분자 분리막 내에서의 분산성 향상
- 고분자 분리막의 나노상 제어
- 나노상 물질의 개질을 통한 투과 및 용해도 향상

기대효과

- 실용화를 목표로 수행하고, 대량생산을 위한 합성법을 제시함으로써 공기, 대기에서 수분의 흡착, 유해가스의 흡착공정에 적용가능
- 나노튜브의 내분에 화학적 기능을 부여함으로써 이산화탄소 포집 및 분리효율 최적화 기대
- 환경산업에서 의학까지 거의 전 산업 범위의 다양한 적용이 예상

Research Goals

- The development of new membrane materials and its modules for the cost effective separation of carbon dioxide from flue gas
- The development of new membrane materials using newly inorganic nanotubes which can be tuned by self-alignment during the formation of membranes as well as the well designed modules for carbon dioxide capture

Research Contents

- Preparation of nanotube (hollow) which is the CO₂ active materials in terms of diffusion and solubility
- Increasing dispersion property of nanotube in polymer matrix
- Controlling nanotube of polymer matrix
- Best performance in terms of permeability and solubility through modification of nanomaterials

Expected Effects

- As the important filler materials, the hollow nanotube can be applied for many different systems such as adsorption of heavy metal ion in water and solid absorbent for hazardous gas
- A variety of chemical functional groups on the surface nanotube can be used for environmentally benign materials
- Lots of applications in various industrial application such as medical, energy and environmental sectors are expected

기술개발 TRM

Contents	Stage 1			Stage 2			Stage 3		
	2011~2012	2012~2013	2013~2014	2014~2015	2015~2016	2016~2017	2017~2018	2018~2019	2019~2020
Development of CO ₂ active nanomaterial	Preparation and synthesis of nanomaterial								
Development of hybrid membrane with CO ₂ active nanotubes	Test of compatibility with polymer matrix	Surface modification of nanotubes	Test and manufacturing of flat sheet and hollow membrane containing high selective/high flux nanomaterial			Establishment of optimum mixing composition of nanotubes inorganic material in the membrane matrix			
Investigation of gas transport performance of membrane	Design of hollow fiber membrane modules of mixed matrix membrane with different composition of nanotubes			Evaluation of process parameter for CO ₂ capture & recovery			Development of CO ₂ capture & recovery process for 10 M ³ /h treatment ability		
Functionalization and evaluation of Mixed matrix membrane	Study on CO ₂ removal and recovery rate of mixed matrix membrane			Test of durability/long-term driving of membrane material			CO ₂ removal and recoveries rate test of hollow fiber membrane modules		
Development of hybrid systems and the operation of membrane process	Modeling of gas transport mechanism of mixed matrix membrane			CO ₂ permeability test of high selectivity/high permeability membrane module			Improvement of hybrid nanomaterial membrane module		
				Optimization of membrane system			Optimization of hybrid system		