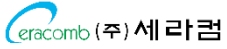


H₂ Removal catalyst & H₂ Eliminator



Outline

Safety facilities that can prevent explosions in advance by removing hydrogen gas generated in the event of an accident at a nuclear power plant, ESS, etc. even without power



Nuclear Power Plant



H₂ Removal Catalyst



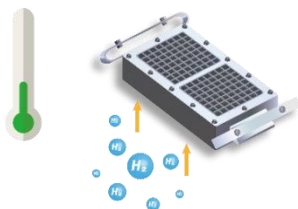
Submarine/ESS

Patents & References

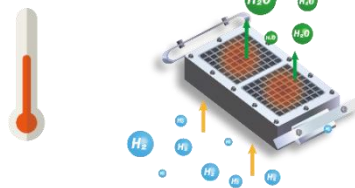
- Patent No. 10-2251413 Energy Storage System
 - Patent No. 10-1760330 Submarine hydrogen removal device for controlling hydrogen in a submarine and method of controlling hydrogen in a submarine using it
 - Patent No. 10-1312857 A passive catalytic recombination device for controlling hydrogen in a reactor and a method of controlling hydrogen in a reactor
- | | | | | | | | |
|------------------------|------------|---------|-------------|--------|-------------|--------------|--------|
| • Nuclear Power Plants | Hanol 1~6 | 170 set | Gori 2~4 | 70 set | • Submarine | Indonesian 向 | 20 set |
| | Hanbit 1~6 | 142 set | Walsung 2~4 | 93 set | | Jangbogo II | 20 set |
| | | | | | | Jangbogo III | 80 set |

Removal Mechanism

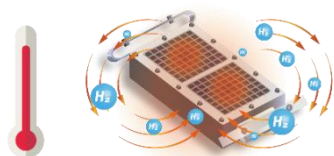
01 H₂ inflow



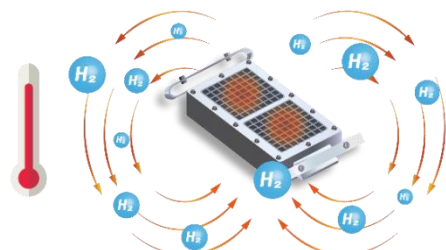
02 Catalytic Reaction (H₂ Removal → H₂O and heat generation)



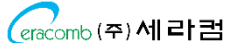
03 Convection occurs



04 Increase H₂ inflow → Increase H₂ removal

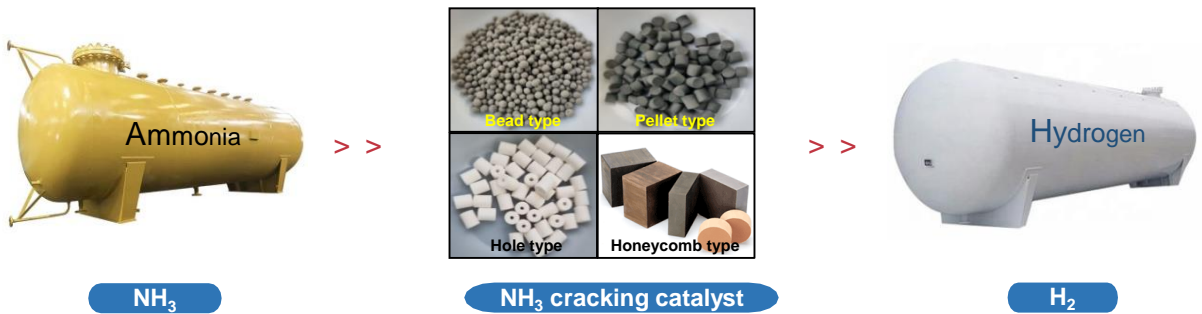


NH₃ Cracking catalyst



Outline

Ammonia Decomposition / Development of Mass Commercialization Technology for H₂ production Catalyst



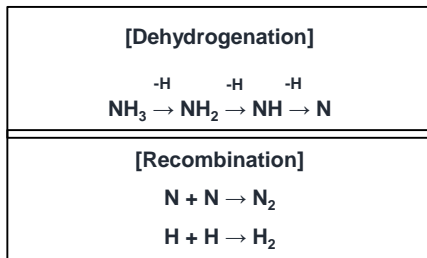
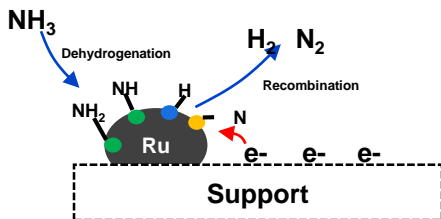
Patents

- ❖ Patent No. 10-2022-0078981 Hydrogen generating device using ammonia decomposition catalyst
- ❖ Patent No. 10-2022-0125230 Ammonia decomposition catalyst for hydrogen generation and its manufacturing method
- ❖ Patent No. 10-2023-0045166 Ammonia decomposition catalyst for hydrogen generation with improved support properties and its manufacturing method

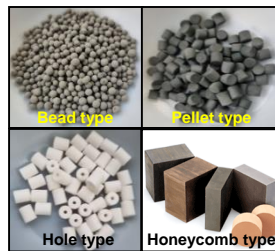
R & D

Ammonia Cracking

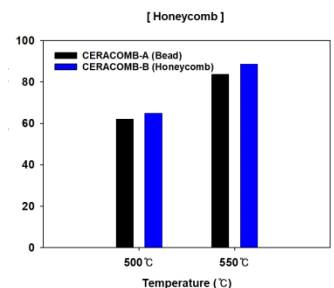
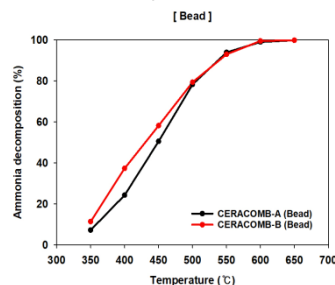
[Decomposition equation]
 $\text{NH}_3 \rightarrow 0.5\text{N}_2 + 1.5\text{H}_2 + \text{endothermic } (\Delta 46 \text{ kJ/mol})$



Technology



• Ru Catalyst

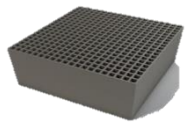
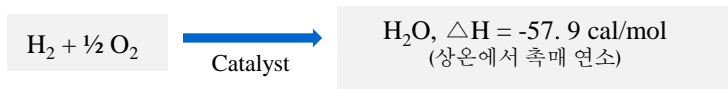




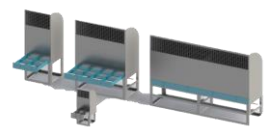
H₂ removal catalyst & H₂ Eliminator

개요

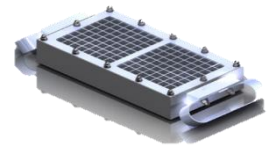
원자력, 발전소, ESS 등에서 사고 발생시 발생하는 수소 가스를 전원이 없는 상태에서도 수소가스를 제거하여 폭발사고를 사전에 방지 할 수 있는 안전설비



< 수소촉매 >



< 원자력 >

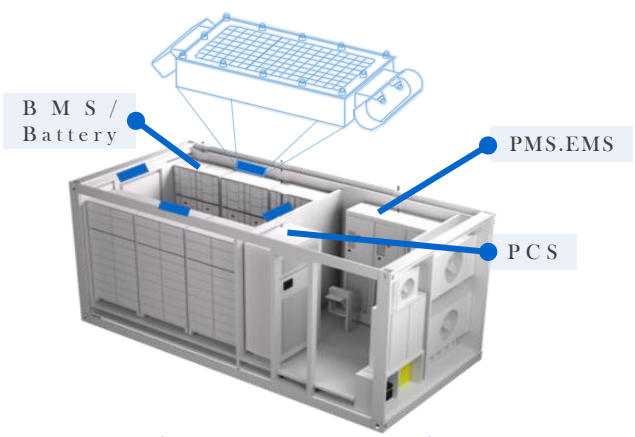


< 잠수함/ESS등 >

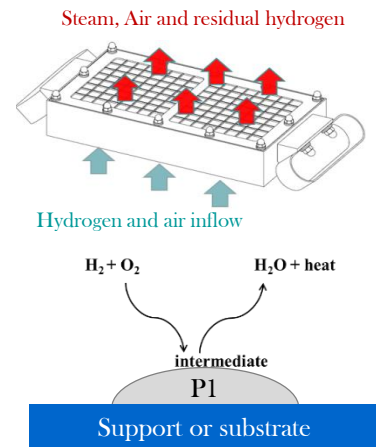
특허현황

- ❖ 특허 제 10-2251413호 에너지저장시스템
- ❖ 특허 제 10-1760330호 잠수함 내의 수소를 제어하기 위한 잠수함 수소 제거장치 및 이를 이용한 잠수함 내의 수소 제어 방법
- ❖ 특허 제 10-1312857호 원자로 내의 수소를 제어하기 위한 피동 촉매형 재결합 장치 및 이를 이용한 원자로 내의 수소 제어 방법

ESS적용



< ESS수소제거기 적용 >



< 제거원리 >

적용실적

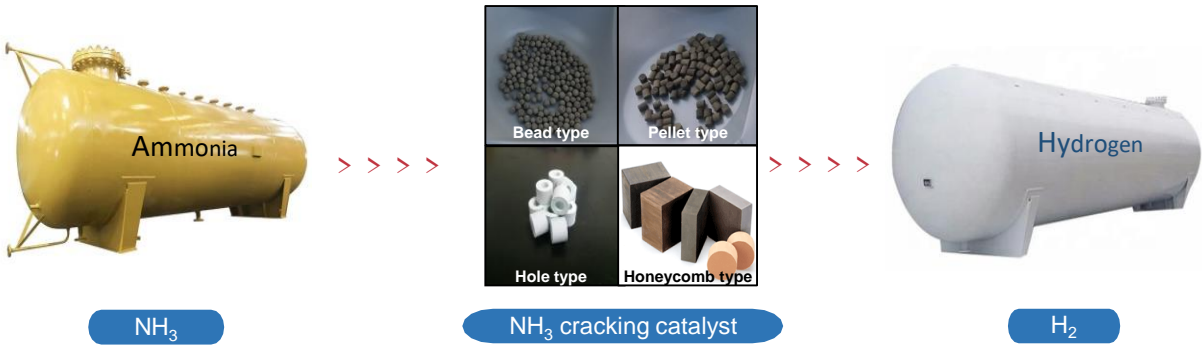
- 원자력 한울 1~6호기 170 SET
- 원자력 한빛 1~6호기 142 SET
- 원자력 고리 2~4호기 70 SET
- 원자력 월성 2~4호기 93 SET
- 잠수함 인니向 20 SET
- 잠수함 장보고III 80 SET
- 잠수함 장보고II 20 SET



NH₃ Cracking catalyst

개요

암모니아 분해/수소생성 촉매 대량 상용화 기술 개발



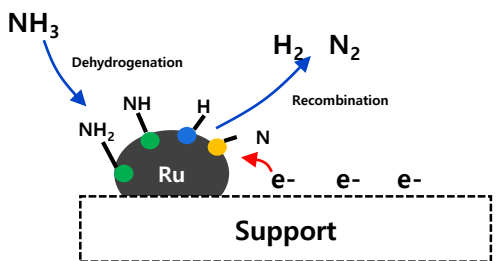
특허현황

- 특허 제 10-2022-0078980 암모니아 분해 촉매를 이용한 수소 발생장치 (촉매 모듈 및 수소이용 열 전달 방법)
- 특허 제 10-2022-0078981 암모니아 분해 촉매를 이용한 수소 발생 장치 (암모니아 추출 수소 촉매의 배열 방법)
- 특허 제 10-2022-0125230 수소 발생을 위한 암모니아 분해 촉매 및 이의 제조 방법
- 특허 제 10-2023-0045166 지지체 특성이 개선된 수소 발생을 위한 암모니아 분해 촉매 및 이의 제조방법

R & D

암모니아 분해 메커니즘

[decomposition equation]
 $NH_3 \rightarrow 0.5N_2 + 1.5H_2 + \text{endothermic } (\Delta 46 \text{ kJ/mol})$



보유 기술

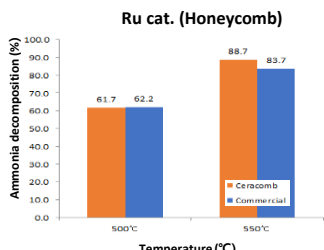
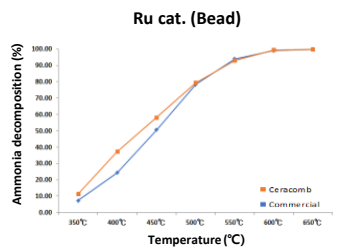
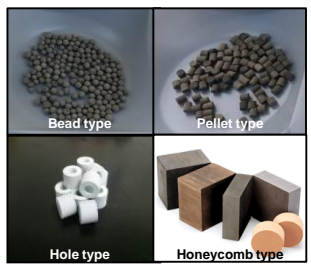


Fig 1. Commercial Bead type vs CERACOMB Bead type

Fig 2. Commercial Bead type vs Ceracomb Honeycomb type