



Research collaboration with Australia on coal technology

National Institute of Advanced Industrial
Science and Technology (AIST)

Tsukuba site

Collaboration with Australia on Coal Technology

Comprehensive MOU with CSIRO in March, 2007

- Collaborative research fields
 - Clean Coal Technology (CCT)
 - Carbon Capture and Sequestration (CCS)
 - Membrane Technology



Research units related to coal technology in AIST

- Energy Technology Research Institute
- Institute for Geo-Resources and Environment
- Materials Research Institute for sustainable Development

1. CCT

CSIRO-AIST collaboration

April, 2007

- Feasibility study titled “Collaboration research on possibility of low-temperature catalytic gasification of ashless brown coal” started.

April, 2008

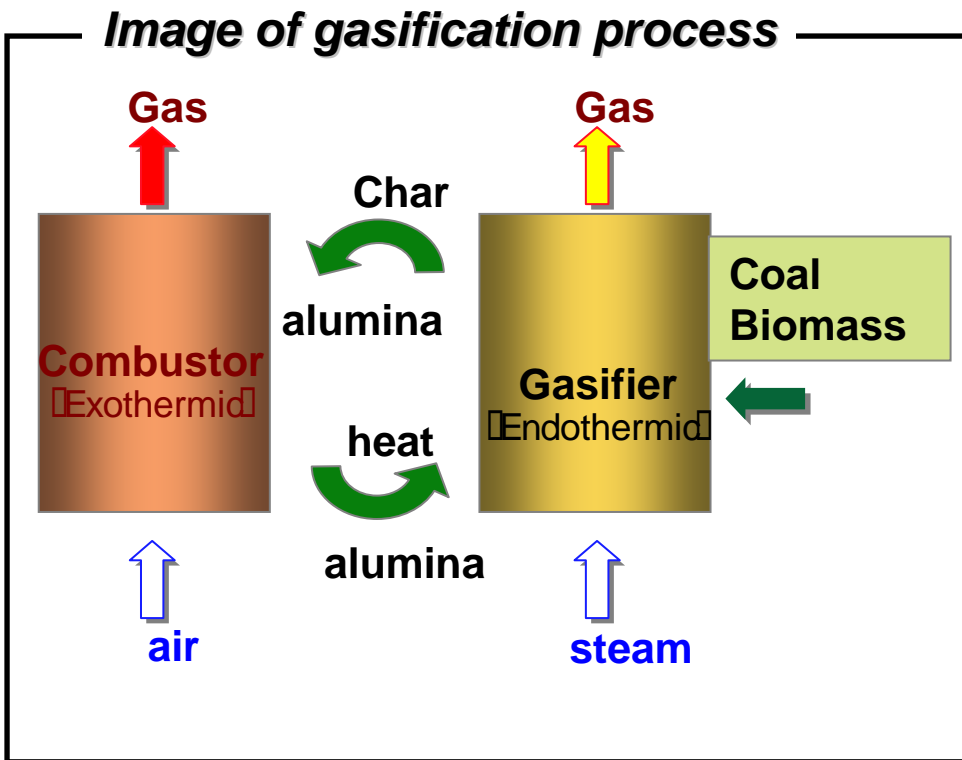
- 2008 Coal Research Workshop(CRWS) at CSIRO/QCAT, Brisbane
 - Theme: Coal gasification and CCS



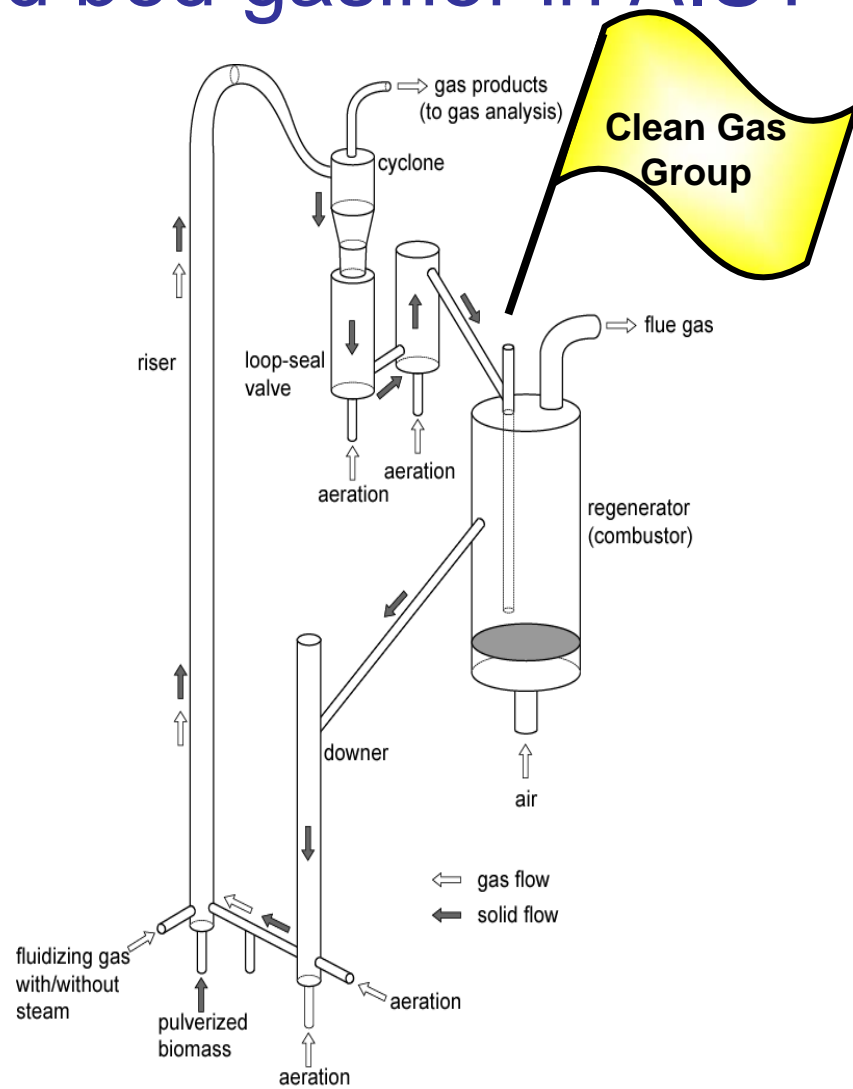
Topics discussed at CRWS for collaboration

- Gasification
 - HyperCoal Gasification
 - Low Temperature Catalytic Gasification
 - Experiments and Numerical Simulations
 - “Coal Bank” reference coal samples and database
- Metal membranes
- CO₂ sequestration in coal

Dual-bed type of fluidized bed gasifier in AIST



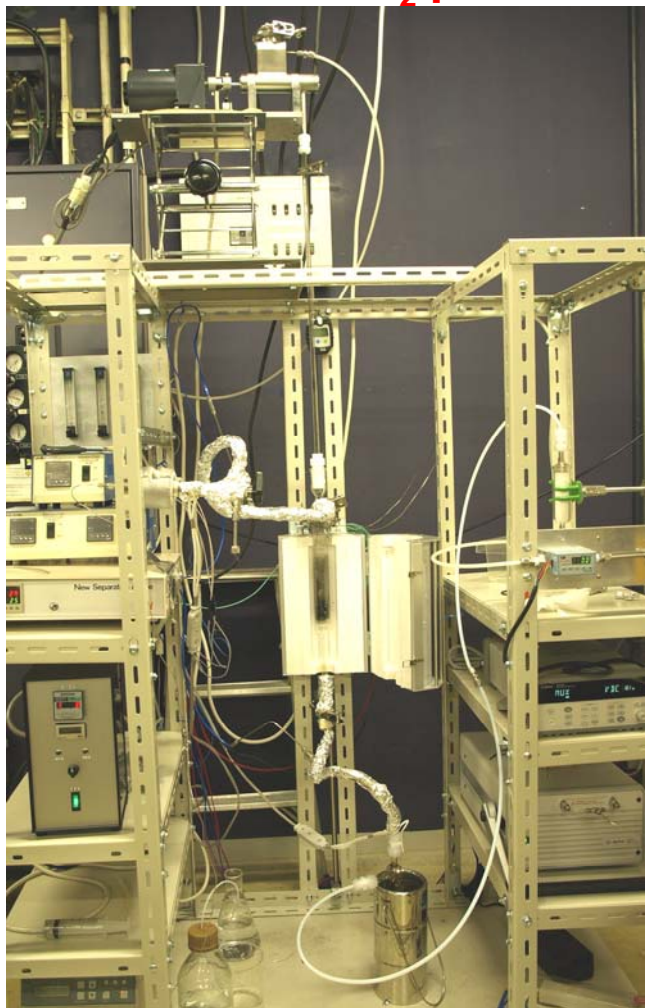
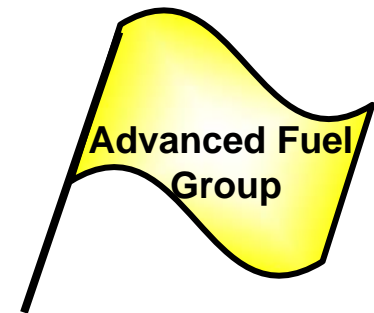
- Circulating of alumina was fairly good.
- Char and coke on the alumina were completely combusted in the regenerator, indicating that alumina was regenerated.



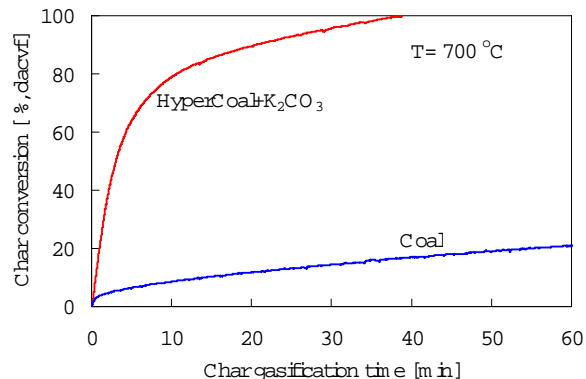
CFB reforming/regeneration system

Hyper Clean Fuel Research in AIST

Zero emission H₂ production Technology from Coal



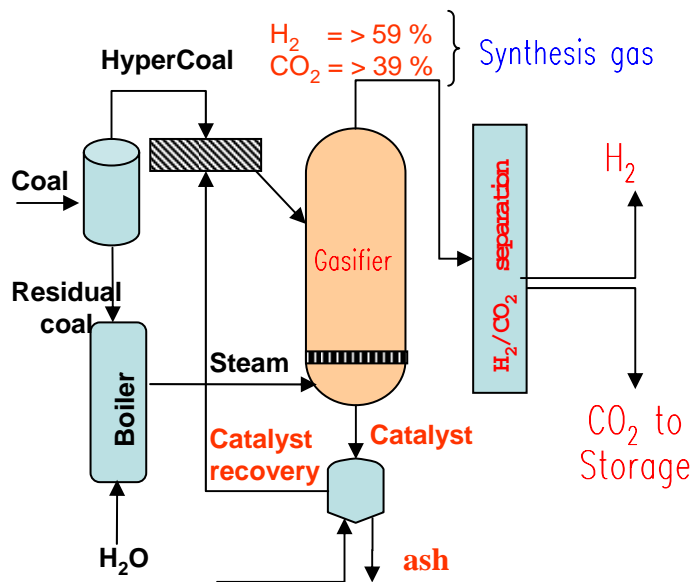
Semi-continuous catalytic gasification based H₂ production experimental setup



HyperCoal & Ash



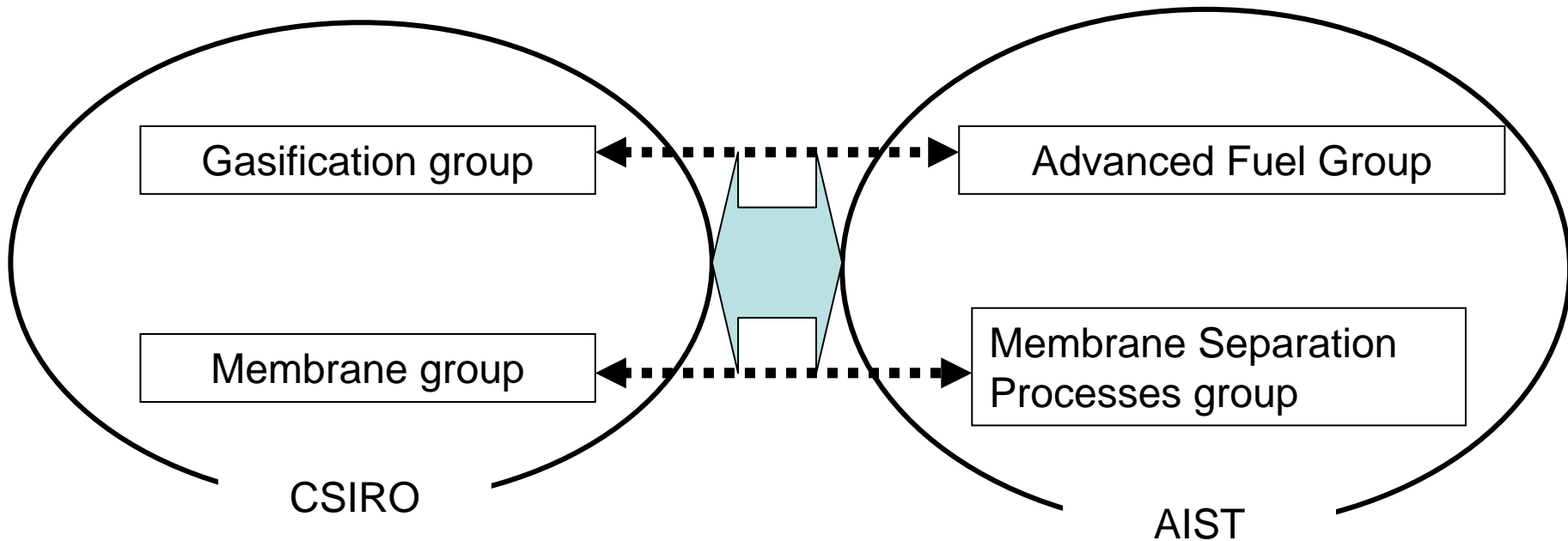
Hypercoal



Zero emission H₂ production process

Proposal of CSIRO-AIST Joint Work

HyperCoal gasification and membranes for low emissions H₂ production



Currently preparing a proposal for the Queensland Government.

2. CCS

Collaboration with Australia

March, 2008

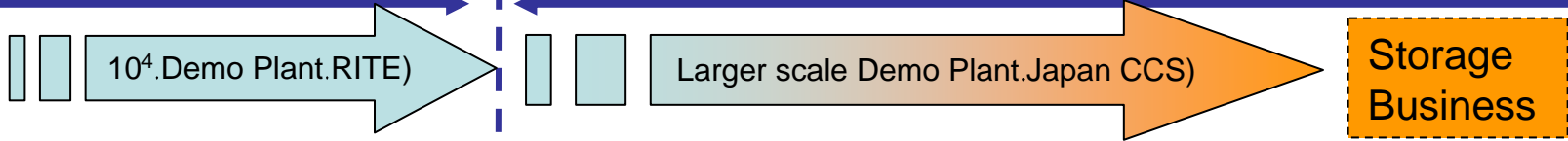
Joint Workshop on CO₂ Geological Storage
at Clayton Research Centre, Melbourne



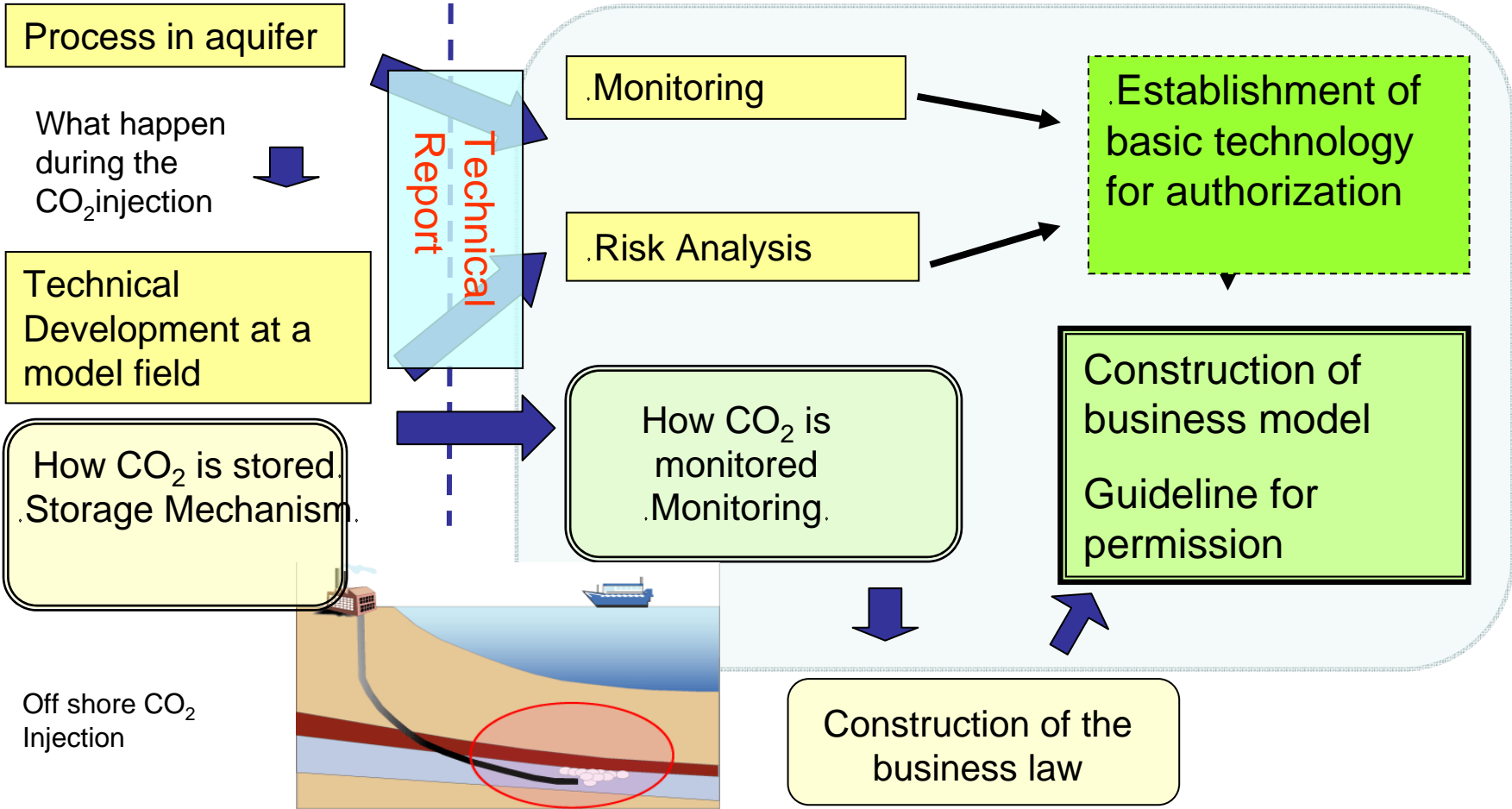
Current time schedule and research targets

2005.2007

2008.2014



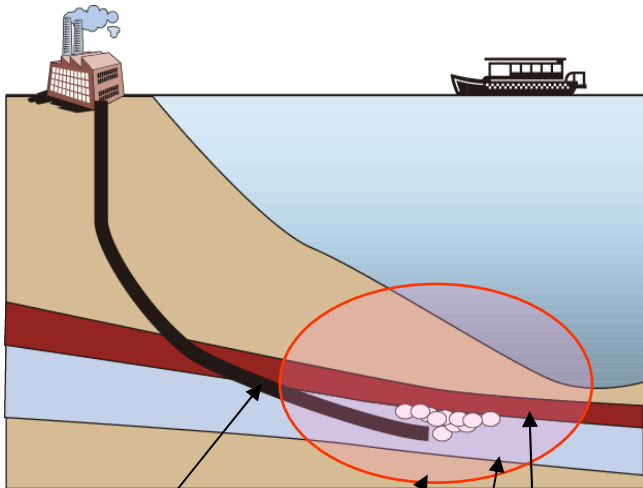
AIST



Proposals on CO₂ storage by AIST

Emission source at sea coast

Off shore storage



Monocline strata

Pressure and temperature for CO₂ supercritical condition

Saline aquifer

Cap rocks

Sink should be located near source.



CO₂ should be injected in a saline aquifer in monocline or syncline formations

Problems to be solved

How CO₂ is stored in a saline aquifer? (mechanism)

- 1) To increase the understanding on CO₂ injection into a saline aquifer
- 2) To make a standard hydrological model of the saline aquifer

How to detect CO₂ ? (monitoring)

- 3) To develop a new monitoring technology using seismic and resistivity data
- 4) To establish a long-term monitoring standard

How to obtain the reliability? (risk analysis)

- 5) To detect the expansion (or leakage) of the injected CO₂ and to develop observation tools at a shallow sea
- 6) To make a business model for the CCS and to obtain a public acceptance

3. Membrane

CSIRO-AIST collaboration on metal membrane

1999

- AIST developed Non-palladium amorphous alloy membranes permeable only to hydrogen.

2005

- CSIRO commenced alloy membrane research.
- Discussion with CSIRO at AIST.

2006 -2007

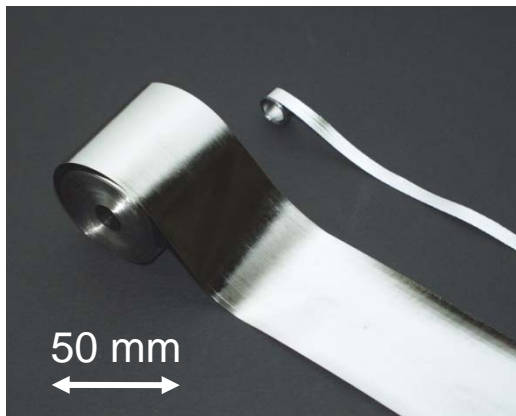
- AIST supplied membrane samples to CSIRO under a material transfer agreement.

2008

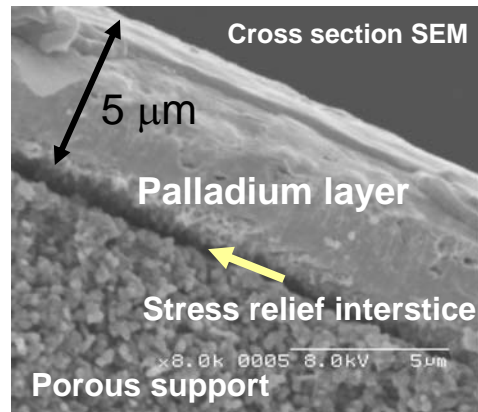
- Coal Research Workshop at CSIRO
- CSIRO-AIST Gas Separation Forum at CSIRO

Japanese Projects

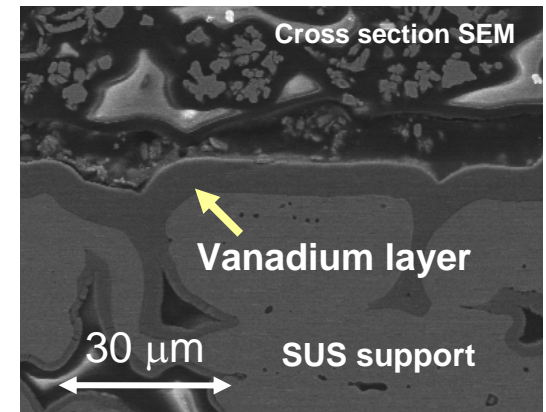
- Promoted by national research grants, since 2000
 - Wide membranes and a hydrogen production system was developed in cooperation with companies in 2005
 - AIST has developed defect-free thin palladium membranes and other metal membranes since 2006



Amorphous alloy membranes



Thin palladium membrane



CVD vanadium membrane

Australian Projects

- CSIRO Energy Transformed Flagship program
 - CSIRO developed amorphous alloy membranes with high stability at high temperature in 2008.
 - CSIRO is developing membrane reformers from natural gas and coal-derived syngas to produce hydrogen.



Amorphous alloy membranes



National Solar Energy Centre



Membrane testing facility