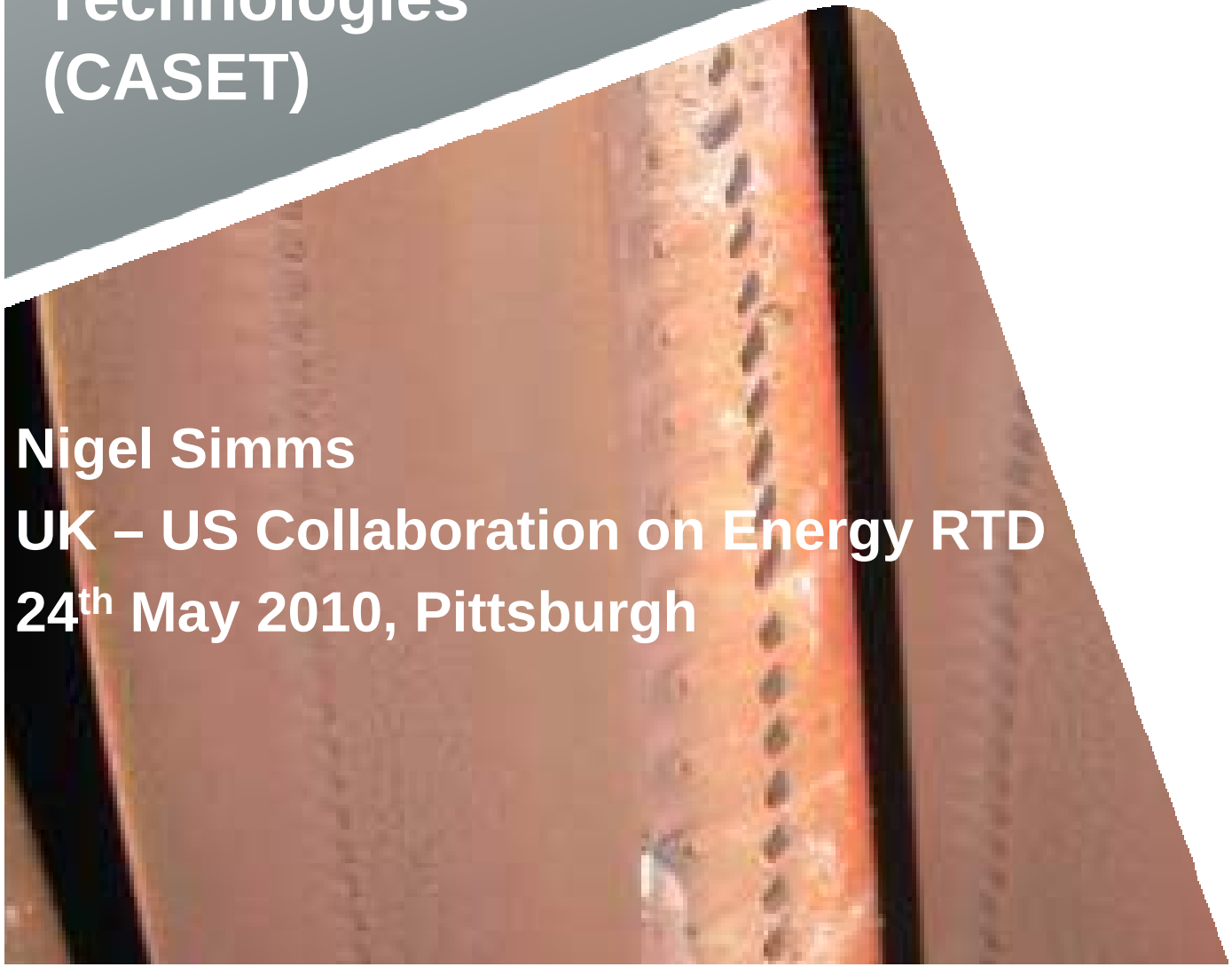
Carbon Abatement Using Surface Engineering Technologies (CASET)



Nigel Simms

UK – US Collaboration on Energy RTD

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http://www.cranfield.ac.uk

CASET - Summary

- Engineering approaches to carbon abatement need to be multi-faceted and based on cost effective, energy efficient solutions with high reliability and durability
- This project is targeted at three main areas of Carbon Abatement Technology (CAT):
  - improved gas turbine conversion efficiency
  - fuel switching to CO_2 neutral fuels such as biomass
  - oxy-fuel fired gas turbines - linked to carbon capture systems
- These CATs will result in more aggressive gas turbine component operating conditions:
  - new coating systems will be required to provide adequate protection of components
  - CASET project to develop new coating systems from concepts to establishing production routes
  - CASET project to evaluate performance of new coating systems relative to existing state-of-the-art systems

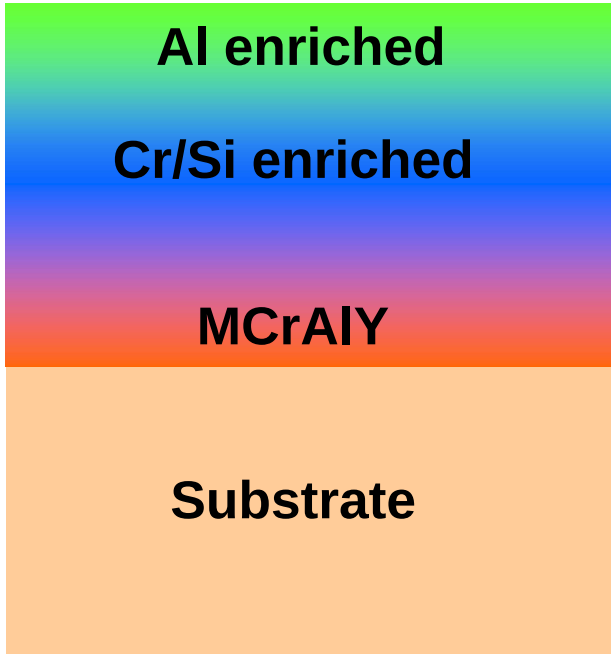
CASET - Partners

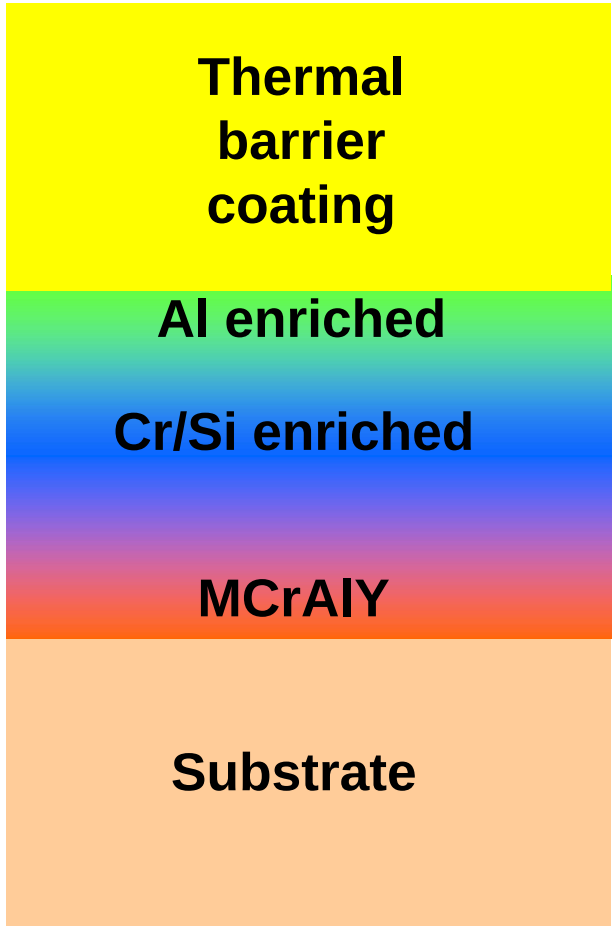
Partner	Business (related to project)	Role in Project
Siemens	Gas turbine manufacturer	System design/specification, mechanical testing, gas turbine exposure testing, project management
Praxair	Coating manufacturer	Coating development, coating supply
RWE npower	Gas turbine user	Gas turbine exposure testing (long term)
University of Birmingham	Research intensive university	Oxidation testing, thermal stability, mechanical testing, characterisation/ analysis, inter-diffusion modelling
Cranfield University	Research intensive university	Operating environment assessment, coating system design/development, hot corrosion testing, characterisation/ analysis, corrosion modelling

Examples of potential new coating systems

Developments of SMART coating system concept:

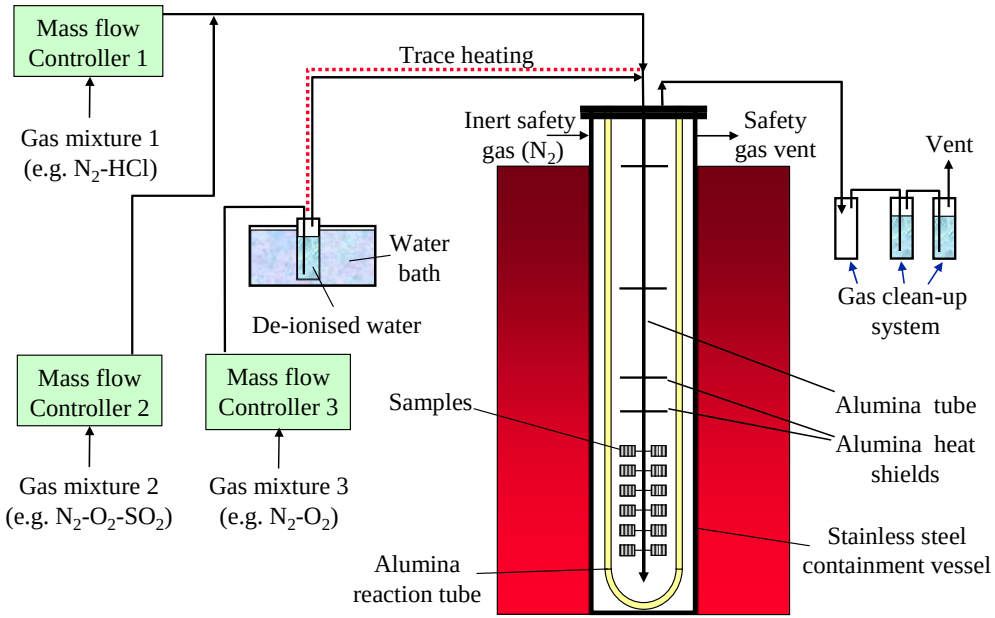
- functionally graded
- multi-layered





Evaluation of coating performance

- Hot corrosion
  - Targeted at specific operating environments:
    - Type I
    - Type II
  - Deposit re-coat testing
    - Controlled atmosphere tests
- Oxidation
  - Thermal balance
  - Cyclic oxidation
  - Exposures up to 8000 hours
- Microstructural stability
- Mechanical properties
  - LCF, HCF
  - RT and high temperature
- Gas turbine exposures



Possible contributions to UK-US activities from CASET project

- Assessment of gas turbine component operating conditions in target CAT systems:
  - improved gas turbine conversion efficiency
  - fuel switching to CO_2 neutral fuels such as biomass
  - oxy-fuel fired gas turbines - linked to carbon capture systems
- Performance of current standard gas turbine materials systems under targeted hot corrosion and oxidation screening tests
- Relative performance of selected new coating systems developed during the course of the project