TASK GROUP REVIEWS

Fossil-fuelled Power Generation
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Fossil Fuelled Power Generation.

• Contents.
  – Scope.
  – Drivers.
  – Main approaches.
  – Generic technology.
  – Materials challenges 5, 10 and 20 years.
  – UK capability.
Fossil Fuelled Power Generation

• **Scope.**
  – Boilers.
  – Steam Turbines.
  – Gas Turbines.
  – Gasifiers.
  – CO₂ Capture.
Fossil Fuelled Power Generation

• Drivers.
  – Reduction of CO$_2$ emissions.
  – Cost (original manufacturer, ownership/use and end of life disposal).

• Main approaches.
  – Increasing plant efficiency.
  – Co-firing with renewable fuels.
  – CO$_2$ sequestration.
• Generic technologies
  
  – Surface protection technologies (coatings).
  – Non-destructive evaluation (NDE).
  – Lifting.
  – Repair.
  – Joining.
  – Recycling
• **Key Materials Challenges – 5 Years.**

- Production and characterisation of prototype components manufactured using identified materials and processes.
- Repair and improvement solutions for existing plant and materials.
- Advanced manufacturing development for existing materials and processes aimed at cost reduction, increased performance and integrity.

Refurbishment and Repair of a Steam Turbine – © Sulzer Metco
• Repair and refurbishment.
  – For current materials, affordable extension of life of current plant.
  – For new materials – extended reliable operation. Designed in as part of materials development.
  – Predictable refurbishment intervals (minimum disruption).
• Key Materials Challenges – 10 Years.
  
  – Development of new material systems (substrate and coatings) based on existing knowledge including behaviour in realistic environments.
  
  – Development and application of process modelling to new materials to speed up introduction and help define new system solutions.
  
  – Adopting a total system approach to critical part design and life prediction with multi-material components with joints and coatings.
• Modelling Materials.
  – Linked (Integrated?) models
  • Material systems – substrate and coatings.
  • Process.
  • Properties.
  • Environmental effects.
• **Key Materials Challenges – 20 Years.**
  
  – Development of novel material systems that will enable high overall efficiencies that will significantly reduce emissions and
  
  – Initial characterisation to identify most promising approaches.

Image © Berlin TU
• Novel Materials Technology.
  – Gas turbine materials targets for 2020.
    • Density <7g cm\(^{-3}\).
    • T capability >2100K.
    • Oxidation resistance 1450K.
    • Creep +100K over current.
    • Ductility equivalent to Ti.
    • Recyclable
  – Material ????
  – Manufacturing process??
  – Etc.
Skills and Capabilities.
- UK based OEMs with technical capability to develop and deploy new materials.
- End users with need to improve/repair, extend plant life and capability to develop the appropriate solutions.
- Supply chain capability in limited areas to develop and supply new materials.
- Strong academic groups and RTOs involved in materials design, development, NDE, repair, joining and lifing.

UK has capability to rise to challenge.
Thank you

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