

TASK GROUP REVIEWS

Nuclear Power Generation

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Energy Materials

- 440 commercial power generating reactors currently operating in 30 different countries
- Total installed capacity 372,000 MWe
- Supply 16% of world's electricity needs
- 30 more reactors currently under construction
- 80 further reactors at various stages of planning

- 19 operational power-generating reactors in the U.K.
- No new plants commissioned since Sizewell B (1995)
- Magnox plants now being decommissioned, then AGRs
- Existing plants currently produce 18% of U.K. electricity
- This proportion predicted to fall to 7% by 2020, and 0% by 2035, unless new plants are constructed

Energy Materials

- 0 – 5 years: support existing plant (lifetime extension, decommissioning, waste management)
- 0 – 15 years: new fission plant construction based on “Generation III” designs available now
- 15 – 30 years: Adopt “Generation IV” reactor designs
- > 30 years: Fusion reactors: ITER and beyond.

Energy Materials

- Reduce time to market and life cycle costs
- Enhance performance in harsh environments
- Improve accuracy of lifetime prediction and management
- Ensure maximum safety and security of operation
- Meet all regulatory requirements
- Exploit synergies between conventional and nuclear power plant research and development

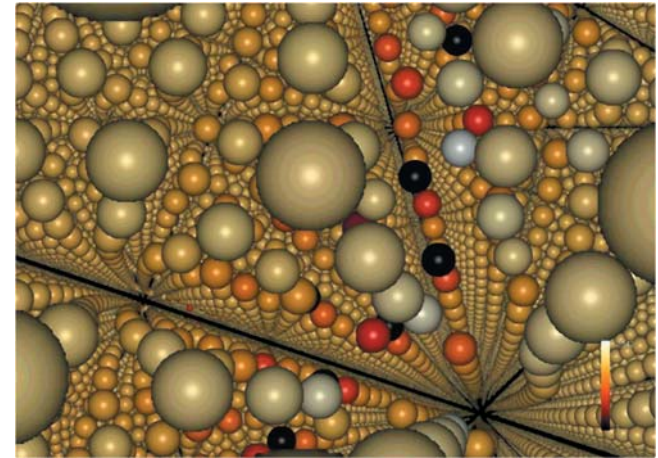
KEY MATERIALS AND SYSTEMS

- Fuel systems: uranium-based materials, zirconium
- Reactors: low-alloy steels, stainless steels, nickel alloys, graphite
- Reprocessing: stainless steels, ceramics, glasses
- Decommissioning and waste management: stainless steels, ceramics, glasses, cements, polymers
- Fusion reactors: steels, ceramics, tungsten, vanadium, carbon



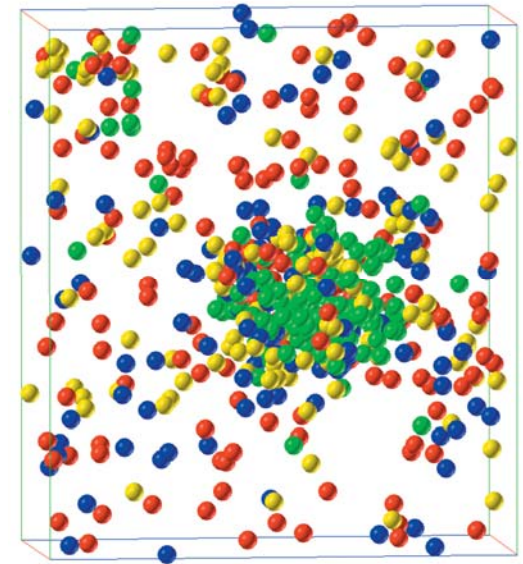
Energy Materials

- Corrosion and erosion
- Crack nucleation and growth mechanisms
- Environmentally assisted cracking
- Creep-fatigue- interactions
- Irradiation creep and swelling
- Thermal cycling
- Joining and interface technologies
- Effects of helium implantation
- Very long term degradation of storage materials
- Techniques for plant monitoring & inspection



Energy Materials

- Long experience in the nuclear industry
- Strong civil engineering sector
- Fundamental scientific skills are excellent, especially in materials characterisation, computer modelling of materials behaviour, and fracture mechanics
- Decommissioning skills for active materials



Courtesy Nexia Solutions

- Steep decline in skilled manpower
- Ageing workforce
- Closure of industrial laboratories
- Lack of irradiation facilities
- Loss of key manufacturing capabilities



Energy Materials

- Strengthen human resource and skills base
- Develop waste management strategy
- Develop “knowledge management” strategy
- Develop “materials capture” strategy during plant decommissioning, to assist studies of long-term ageing and degradation of reactor materials
- Establish national facility to study irradiated materials



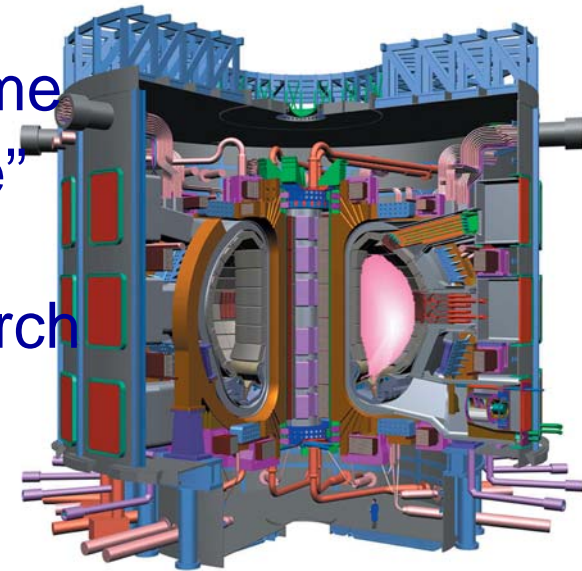
Courtesy Nexia Solutions

Energy Materials

Four key areas where the UK has strengths and where research effort should be concentrated:

- Corrosion and degradation of materials
- Long term integrity of welded structures
- Irradiation damage effects on reactor materials
- Improvement of methods for monitoring and inspection of reactor systems

- Focus UK research agenda on selected topics
- Re-build the UK skills base in this area
- Re-establish key experimental facilities
- Set up “knowledge management” programme
- Link decommissioning to “materials capture” exercise
- Link conventional and nuclear power research
- Link fission and fusion research
- Build strong international collaborations
- Re-join the “Generation IV” development consortium
- Bid to host major international fusion materials irradiation facility (IFMIF)



Thank you

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