

Progress on Materials Engineer Function

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Goals for CY 2002 (From 1/02)

- Oversee completion of at least two requests for fusion materials data/information.
- Creates special web site for fusion materials data and place advanced ferritic steels, SiC/SiC composites and FLiBe data on the web site.
- Draft a standard for formatting of fusion materials data/information.
- Actively participates in workshops on SiC/SiC composites and advanced ferritic steels.

Requests for fusion materials data/information.

- Effect of porosity on Be electrical conductivity
- Stress allowables for advanced ferritic steels
- Allowable temperatures for Pb ferritic steel interface.
- Interactions between Be and ferritic steels
- Creep relaxation stress allowables
 - To be done

Materials Information Requests

- Process thus far has been relatively informal
- Need to consider a more formal request process that insures adequate review
 - Request forms
 - Established procedures for review in materials community
 - Role of materials community in setting limits vs designers setting limits based upon information
- Designers may request new or more active programs for addressing issues
 - Pb compatibility with NFAs

Web site for fusion materials data

- Working with Nasr Ghoniem and Shahram Sharafat to set up site at UCLA
- Visit in June to work out details.
- Use either Filemaker Pro, Oracle, or 4D database software on server.
- Shahram will present further details

Materials Database

- Consider multiple levels of access
 - Property curves/equation applied to design
 - Graphs of data
 - Tabular listing of data
 - References and abstracts
- Active relational database that can be queried online.
- Experts are able to upload revisions directly
- Use commercially available software

The Design Process

- Set major design parameters
- Determine feasibility of in-vessel components
- Look at operating behavior and performance
- Assess lifetime/reliability
- Materials needs tend to be rather basic, but for a much wider variety of materials than those in the materials program
 - Melting point of Flinabe
 - Interface conductance of Be/SB pebbles

What is Failure?

- Loss of plasma performance
- Exceed dimensional limits
- Reduction of heat removal capability
- Reduction of T breeding/removal
- Unacceptable risk for catastrophic failure
- Safety barriers in jeopardy
- Availability/performance drops

VISTA

- Overall goal – Develop full 3D, dynamic modeling capability to predict all aspects of performance and response of fusion in-vessel components.
- Objectives
 - Develop a blanket structural model to be used for predicting response of ITER test blanket modules
 - Develop a high heat flux structural model that can be used for predicting response of plasma facings components and first wall for Burning Plasma Experiment.
 - Develop models of non-structural materials that can be used to predict behavior and performance of ITER test blanket modules.

VISTA

- Need to focus on model building applicable to design
- Breadth vs depth of models?
 - Sensitivity studies
- Transient vs steady state behavior?
- Safety factors applied to data
- Modular approach so new models can be added as they become available
 - Standardized format for inputs and outputs
- Importance of detailed component history for behavior response
 - Material damage functions
- Effects of random events
 - Temperature excursions
 - Disruption EM forces
 - Loss of surface thickness

Back to the Future

- "We shall not cease from exploration and the end of all our exploring will be to arrive where we started and know the place for the first time" - T.S. Eliot