International Workshop on Ceramic Breeder Blanket Interactions

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- Welcome to UCLA

- Issues Facing Blanket Community

- Specific Issues for Solid Breeder Blanket Community

Issues Facing Blanket Community

1. **Resources**

   - Funding for Blankets remains too small to carry out serious and timely Blanket R&D Program

   - Trends of Decline in Blanket Funding is alarming

   - To be ready for testing blanket in fusion facilities (ITER and VNS) in the year 2006 requires World Blanket Program~ $100M/yr (Now it is only ~ $30M/yr)

2. **Near Term R&D Tasks**

   - Non-Fusion Facilities (existing and new)

   - Experiments, Modeling and Analysis

3. Fusion Testing Facilities

Need to ensure that there is a fusion facility adequate for blanket testing by the year 2005

ITER

- Need to improve parameters and design to be more suited for blanket testing (pulsing/steady state, fluence, etc.)

VNS

- VNS is a dedicated facility to test, develop and qualify fusion nuclear components, particularly ITER, for DEMO

- VNS will provide
    - Driver for FNT R&D now
    - Timely Data for lower risk DEMO

Specific Issues for Solid Breeder Blankets

1. **Overcome "Unfair and Uninformed" negative perception developed in discussions of ITER Driver Breeding Blanket**

2. **Continue Improvements in Design**

   - Design activity to incorporate new data is needed

   - Need to show attractive design(s)

3. **Focus on Selected Blanket Options**

   - Select 2 solid breeder materials

   - Select no more than 2 or 3 configurations

   - Coolant? Helium alone? Pressurized Water?

   - Structural material?

4. **Near Term R&D Tasks**

- Complete Material Property Data Base

- Begin construction and operation of experiments for more integrated tests (interactions among elements)

- Submodule experiments in fission reactors

5. **Develop Plan for Construction and Testing of Modules in Fusion Facilities**

- Also, ensure that fusion facilities to be operated in the early 2000's are suitable for testing solid breeder blankets

Blanket Options for DEMO

Breeder	**Coolant**	**Structural Material**
A. Solid Breeders Li_2O, Li_4SiO_4, Li_2ZrO_3, etc.	He or H_2O	FS, V alloy, SiC
B. Self Cooled Liquid Metals Li, LiPb	Li, LiPb	FS, V alloy with Electric Insulator (SiC with LiPb only)
C. Separately Cooled Liquid Metals Li LiPb	 He He or H_2O	 FS, V alloy FS, V alloy, SiC

- All options have feasibility and performance issues.
- Resolving many of these issues requires testing of material combinations in subcomponents in the fusion environment (n, γ, B, T, V, etc.).
- R&D needs: basic properties, material interactions, synergistic effects; technology for alloy production, fabrication, etc.

Why Fusion Nuclear Technology is Crucial to Fusion

Blanket/FW

- Many feasibility issues
  [We are not sure there is a blanket that will work.]
- Many of fusion attractiveness issues are blanket issues

Renewable Energy Source

Must demonstrate tritium self sufficiency (blanket issue)

Environment/Safety

- FW/blanket exposed to the most intense 14 MeV neutrons
- High heating rate, high temperature
- High stresses
- Tritium production, transport, permeation, inventory
- Decay heat
- Radioactivity
- Highest failure rates, potential accidents

Developing and demonstrating blanket component that can simultaneously produce tritium, extract high grade heat, without severe accidents and without large radwaste must be a dominant focus of fusion R&D (next to plasma physics)

Reliability/Availability (Practicality of Fusion Systems)

- DEMO availability > 50% requires blanket availability > 95%
  i.e. MTBF > 3 yr
  (Estimate of presently achievable MTBF is hours)

Need engineering component development which will take long time [estimates from experience in other technologies]

- Testing in non fusion facilities now
- Testing in fusion environment (ITER and VNS)