Plasma Facing Component Technology

5 Year R&D Plans

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Key PFC R&D Thrusts

- Qualification testing of Be/Cu PFCs
- ELM Effects on W PFCs
- Experiments on T Retention in mixed materials
- Development of He cooled refractory PFCs
- Support for domestic device PFC needs
- Endurance tests of rods versus lamellae
- Improvement of Boundary Physics Modeling
- Liquid Surface PFC development
- Improvement of liquid surface modeling
- Improvement of PMI modeling

R&D Thrust Description (1)

1. Qualification of Be/Cu: Conduct high heat flux tests on mockup Be/Cu PFCs to find the best joining method. Investigate the effect of built in flaws. Conduct 30,000 cycle fatigue test of best.
2. ELM effect on W: Determine melting threshold for ELMs with normal heat flux. Measure damage due to thousands of ELMs above and below melting.
3. T Retention in mixed: Make samples of mixed codeposits of Be/W and Be/C. Measure T retention using TPE as plasma source.

R&D Thrust Description (2)

4. He Cooled refractory: Extend He cooled heat sink research from Cu to refractory metal and explore the benefits of various heat removal enhancement schemes (e.g., fins, porous surface, etc.).
5. Domestic PFC needs: Continue to provide high heat flux testing to support upgrades to PFCs on domestic machines (C-Mod, DIII-D, NSTX, …)
6. Rods vs. Lamellae: Study the high cycle differences between rod and lamellae surface PFCs.

R&D Thrust Description (3)

7. **Boundary Physics Modeling: Develop new boundary plasma diagnostics. Use data to benchmark improved BP models (UEDGE/Degas, etc.)**
8. **Liquid Surfaces: Continue development of liquid surface PFCs. Measure heat and particle removal capability. Find practical schemes for fusion devices.**
9. **Liquid Modeling: Continue to improve Liquid MHD computational models and benchmark to experiments.**

R&D Thrust Description (4)

10. PMI modeling: Continue laboratory experiments to measure erosion and deposition of fusion materials. Continue to advance computational models based on experiments. Better couple PMI models to Boundary Plasma models.

Current Spending

• Qualification of Be/Cu PFCs	$1500K
• ELM Effects on W	$300K
• T Retention in mixed materials	$350K
• He cooled refractory PFCs	$0K
• Support for domestic needs	$200K
• Rods versus lamellae	$200K
• Boundary Physics Modeling	$900K
• Liquid Surface PFC	$800K
• Liquid surface modeling	$200K
• PMI modeling	$2000K

Based on FY06 Planning; includes $1200 base to ITER

Mapping of Thrusts to VLT Missions

	ITER Base machine	R&D needed for ITER to be successful	ITER as test bed (TBM, etc)	Next generation technology (for current and future machines)	Longer Term R&D
1. Be/Cu	X				X
2. ELM on W		X		X	
3. T in Mixed		X		X	
4. He Refractory			X		X
5. Domestic PFC				X	
6. Rods vs. Lamellae		X		X	X
7. BP modeling		X		X	X
8. Liquid PFC					X
9. Liquid MHD					X
10. PMI modeling		X		X	X