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ADVANCED HIGH PERFORMANCE SOLID WALL BLANKET CONCEPTS

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ADVANCED HIGH PERFORMANCE SOLID WALL BLANKET CONCEPTS*

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Abstract: First wall and blanket design is a crucial element in the performance and acceptance of a fusion power plant. High temperature structural and breeding materials are needed for high thermal performance. A suitable combination of structural design with the selected materials is necessary for D-T fuel sufficiency. Whenever possible, low afterheat, low chemical reactivity and low activation materials are desired to achieve passive safety and minimize the amount of high-level waste. Of course the selected first wall and blanket design will have to match the operation scenarios for high performance plasmas. The key characteristics of six advanced high performance blanket concepts are summarized in the following table.

	TAURO	ARIES-AT	A-SSTR-2	W/Li/He	EVOLVE	FFHR-2
Application	Tokamak	Tokamak	Tokamak	Tokamak	Tokamak	Stellerator
Structural material	SiC_f/SiC composite	SiC_f/SiC composite	SiC_f/SiC composite	W-alloy	W-alloy	V-4Cr-4Ti
Tritium breeder (Multiplier)	LiPb (none)	LiPb (none)	Li_2TiO_3 (Be)	Li (none)	Li (none)	Flibe (Be)
Breeder form	Liquid	Liquid	Pebbles	Liquid	Liquid	Liquid
Coolant	LiPb	LiPb	He	He	Vaporized Li	Flibe
Local TBR (Li-6 enrichment)	1.37(90%)	1.1 “3-D” (natural)	1.37 (natural)	1.43 (35%)	1.33 (natural)	1.4 (50%)
Ave. FW heat flux, MW/m^2	0.5/0.69	0.26	1.4	2 (peak)	2 (peak)	0.25
Neutron wall loading, MW/m^2	2/2.8	3.2 (Avg.)	6 (Avg.)	10 (peak)	10 (peak)	1.7 (Avg.)
Coolant T_{out}, °C	860	1100	900	1100	1200	700
Thermal eff., %	47	58.5	50	57.5	57	45

This paper will review the configuration, performance characteristics and advantages of these advanced conceptual designs. Unique properties and critical issues of these designs will also be summarized.

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